A MANAGEMENT INFORMATION SYSTEM TO
ESTIMATE CONTROLLED MATERIALS
REQUIREMENTS FOR AIR
FORCE CONTRACTS

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LSSR 24-78A

USAF SCN 75-20B AFIT Control Number LSSR 17-78A

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER LSSR 24-78A	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A MANAGEMENT INFORMATION SYSTEM TO ESTIMATE CONTROLLED MATERIALS REQUIREMENTS FOR AIR FORCE CONTRACTS		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Thomas F. Pustis, Captain, USAF David J. Wallace, Captain, USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Graduate Education Division School of Systems and Logistics Air Force Institute of Technology, WPAFB OH		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of Research and Administrative Management AFIT/LSGR, WPAFB OH 45433		12. REPORT DATE June 1978 13. NUMBER OF PAGES 128
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

APPROVED FOR PUBLIC RELEASE AFR 190-17.

JERRAL F. GUESS, CAPT, USAF
Director of Information

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Management Information System , Defense Materials System, Data Processing Report Generation, Controlled Materials.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Thesis Chairman: Larry L. Smith, Lt Col, USAF

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The purpose of the thesis effort was to plan and design a management information system for the Joint Aeronautical Materials Activity (JAMAC). The developed system generates materials requirement estimates for controlled materials used during performance of United States Air Force contracts. Controlled materials requirements for such contracts are prepared for seven program identification codes (A-1, A-2, A-6, A-7, C-2, C-3, and C-9) as established by the Defense Materials System. The computer program used to generate the requirements makes use of matrix algebra routines. System output includes the materials requirement estimates for each program identification code and accuracy/audit lists.

LSSR 24-78A

A MANAGEMENT INFORMATION SYSTEM TO ESTIMATE CONTROLLED MATERIALS REQUIREMENTS FOR AIR FORCE CONTRACTS

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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June 1978

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MASTER OF SCIENCE IN LOGISTICS MANAGEMENT (PROCUREMENT MAJOR)

DATE: 14 June 1978

Larry L. Smith

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Chapter 1

INTRODUCTION

The Defense Materials System is defined by a body of government regulations and orders promulgated under the authority of the Defense Production Act of 1950 to accomplish two main purposes: (1) to insure that defense programs are maintained on schedule by providing priority treatment for the purchase of products and materials by defense agencies, contractors, subcontractors and their suppliers, and (2) to maintain an administrative framework by which the total economic resources of the United States could be mobilized should the need arise (4:1-5).

Although primary functional jurisdiction for the operation of the Defense Materials System is maintained by the Department of Commerce, specific delegations of functional authority have been made to the Department of Defense (DOD) (6:p.1-3). Within the DOD, the Joint Aeronautical Materials Activity (JAMAC) is charged to accomplish the objectives of the delegations.

Problem Statement

JAMAC's responsibilities include the reporting of estimated materials requirements through the DOD to the Federal Preparedness Agency, General Services Administration.

The gross estimates of materials requirements are used by the Federal Preparedness Agency to establish set-aside portions of the productive output of specific material producers for the exclusive use and procurement by organizational entities performing work in support of defense programs (4:8-9).

To estimate materials requirements, JAMAC uses quarterly material estimates of selected defense contractors. The contractor-prepared quarterly estimates are of large volume and contain numerous types of information. Presently, JAMAC essentially hand manipulates all received data to arrive at gross totals, sub-class material breakouts, and material forecasts.

The problem for research is that there is a need to plan and design a management information system that will consolidate and synthesize forecast material requirements for JAMAC.

Justification

Mr. W. Wallace Wetterling, Civilian Administrator, JAMAC (7), defined the need for a management information system. Such a system would ideally enable JAMAC personnel to reduce the amount of time expended performing essentially clerical tasks and pursue more productive and meaningful effort. To achieve this end, Mr. Wetterling requested that the feasibility of planning and designing a management information system be explored (7).

Objectives

As the definition of a management information system stresses satisfaction of information requirements and the system specification stage of planning and design stresses providing such information, it follows that the objectives of this effort should be directed accordingly.

First, the information needs and desired output of such a system must be determined in order to satisfy the management needs of JAMAC. Second, a workable algorithm must be planned and designed which is capable of meeting the management needs of JAMAC. Third, the algorithm must be programmed and tested for effectiveness and compatibility with JAMAC's management needs.

Research Questions

Given the pragmatic orientation of this research effort, the appropriate research questions which must be answered to effectively accomplish the stated objectives are:

1. What are the specific desires/requirements of JAMAC that must be incorporated in a management information system?

2. How can the identified desires/requirements be satisfied and incorporated within a workable management information system algorithm?

3. What are the criteria necessary to test the algorithm for validity, effectiveness, and compatibility?

Overview

This study is presented in four parts. They consist of a literature review, a description of the methodology, the results of the research, and the results of the thesis effort.

The next chapter will review current literature in order to provide a background for development of a management information system.

Chapter 2

LITERATURE REVIEW

Legislation and Implementation

Subsequent to World War II and the Korean War, in recognition of the difficulties experienced in allocating resources between the civilian and military sectors of the national economy and in mobilizing the industrial capability of the United States, legislative action was undertaken to prevent reoccurrence of similar problems in future exigent periods. Briefly stated, the Defense Production Act of 1950 provided the President authority to " . . . allocate materials and facilities for the purpose of promoting the national defense [4:2]." The term "national defense" is defined in the Defense Production Act as " . . . programs for military and atomic energy production or construction, military assistance to any foreign nation, stockpiling, space, and directly related activity [4:2]." Subsequent to receiving such authority, the President delegated performance authority among various agencies of the federal government.

Overall authority for the direction, control, and coordination of programs under the Defense Production Act was delegated to the Director of the Federal Preparedness

Agency, General Services Administration. Specific functional authority and responsibility were delegated to:

> 1. The Secretary of the Interior with respect to petroleum, gas, solid fuels and electric power (portions since redelegated to the Administrator, Federal Energy Administration);
> 2. The Secretary of Agriculture with respect to food and the domestic distribution of farm equipment and commercial fertilizer;
> 3. The Commissioner of the Interstate Commerce Commission with respect to certain limited, domestic transportation functions; and
> 4. The Secretary of Commerce with respect to all other materials and facilities [4:3].

The Secretary of Commerce subsequently designated the Bureau of Domestic Commerce, Domestic and International Business Administration, as having primary implementation and maintenance authority for that authority delegated to the Department of Commerce. Within the Bureau of Domestic Commerce, implementation was accomplished by creating a body of regulations and orders entitled the Defense Priorities System and the Defense Materials System. The systems exercise control over industrial production and the allocation of designated materials (4:1-3).

Currently, the systems are applicable to thirty-seven programs of the

> . . . Department of Defense (DOD), Atomic Energy Programs of the Energy Research and Development Agency (ERDA), the Department of Commerce (DOC), the Department of Interior (DOI), and certain other agencies referred to as 'associated agencies of the Department of Defense'

having responsibilities for specific defense-related programs [4:5].[1]

As such, any government or non-government organization engaged in the performance of a defense program is subject to and must comply with the requirements of the systems. A listing, brief description, and identification of the government agency responsible for each program are displayed in Appendix A.

The Defense Priorities and Defense Materials Systems

To assure implementation of the two systems, all contracts awarded by a government agency in support of a defense program must use contractual clauses which require compliance with the systems' regulatory requirements and identify the actions required by a contractor. For example, the Armed Services Procurement Regulation requires use of such a contract clause in all defense program contracts except those of value less than $500.00 (5:p.1:27). In addition to the insertion of a mandatory clause, all defense program contracts are assigned a symbolic priority rating. All priority ratings must originate within a procuring defense or "associated" agency.

[1]The "associated agencies" of the Department of Defense are the Central Intelligence Agency, the Federal Aviation Administration, and the National Aeronautics and Space Administration.

Within the Defense Priorities System, there are two priority ratings, "DX" and "DO". The majority of procurement performed in support of defense programs automatically assume a "DO" rating. However, programs selected by the President as having highest national priority for accomplishment are assigned a "DX" rating (6:p.1-3). Generally, a "DX" or "DO" rated contract should not be considered as having a strictly superior-inferior ranking in relation to each other. Both are performed in support of national defense programs and are, therefore, of equal importance within the national economy. Any rated contract is accorded preferential treatment in relation to purely commercial orders in terms of contract acceptance and delivery (4:10-16).

The net result of contract clause insertion and the assignment of a priority rating is the assurance that the following occurs within the national economy: any contractor or supplier who receives a rated defense contract or order will employ the priorities powers of the Defense Production Act in obtaining " . . . products, materials, or services needed to complete production, construction and research and development projects for defense programs [4:5]." Additionally, prime contractors to whom the priority rating is assigned must place the symbolic priority on and insert appropriate clauses within the subcontracts or purchase orders placed to complete a

defense contract. In turn, the subcontractor must accomplish the same task. The use of a priority rating is expressly prohibited unless received from a defense agency or customer (4:7). Finally, proper identification of a rated contract provides the means by which the resource requirements of a defense program are satisfied.

In the specific case of Department of Defense procurement, " . . . rated contracts and purchase orders . . . may be placed on selected suppliers when adequate response to a solicitation is not received [5:p.1:27]." For example, should a situation arise wherein no bids or proposals are received as a result of a solicitation or if the bids or proposals do not cover the requirement, an attempt should be made to locate alternate sources to the extent existing conditions will permit. In the event this effort fails and it is determined that the procurement must be accomplished, then " . . . rated orders in the form of rated contracts, rated purchase orders . . . shall be presented, to one or more (as appropriate) selected suppliers or manufacturers qualified to produce the item or material [5:p.1:28]." This action is to be accomplished by a cover letter signed by the contracting officer " . . . citing requirements of the Defense Production Act and Defense Priorities System Regulation 1, and requesting timely acceptance thereof by the contractor [5:p.1:28]." Additionally, the letter shall request that the contractor

promptly furnish any reasons for rejection in writing. Should the contractor refuse, rejected orders are to be forwarded to the Bureau of Domestic Commerce, via established channels, for action which the bureau deems fit (5:p.1:28). It should be noted that order rejection on the part of the contractor is a violation of federal statute.

In addition to the foregoing, a more subtle, persuasive factor exists to insure the effectiveness of the priority rating through the workings of the Defense Materials System. The Defense Materials System provides the means by which the availability of basic materials used in the manufacture of defense items is insured. Basic materials considered crucial to the manufacture of defense items, entitled "controlled materials", are indirectly made available to a contractor through a system of allotments and set-asides. The controlled materials are steel, copper, aluminum, and nickel alloys. The Defense Materials System provides that a contractor engaged in the production of "Class A" or "Class B" products will be assured of the availability of controlled materials to complete his contract. Class A products are " . . . those products containing controlled materials and which are designed specifically for military use, but are not in themselves controlled materials [4:17]." Additionally, components of a Class A product specifically designed to

military specifications are Class A products. Class B products are " . . . standard commercial products which contain controlled materials, but which in themselves are not controlled materials [4:17]." An example of a Class A product would be a fighter aircraft whereas a Class B product would be a standard diesel generator regularly produced for commercial sale.

The manner in which set-asides and allotments assure the availability of controlled materials is as follows. On a quarterly basis, estimated requirements for controlled materials are submitted to the Federal Preparedness Agency by "claimant agencies"; i.e., the Department of Defense, Bureau of Domestic Commerce and so forth. Upon consolidation of the requirements, the Federal Preparedness Agency establishes a set-aside of the productive output of controlled material producers. The set-aside amount established is a ratio between current defense needs and shipments made by the producers during a base period. This set-aside must be made available for defense purposes. The Federal Preparedness Agency thereupon issues an allotment to the claimant agencies which are in turn sub-divided until the major operating elements of the agency receive an allotment. It should be noted that allotments are not issued to defense contractors; the contractors receive controlled materials by placing an

Authorized Controlled Material Order[2] with the producer of controlled materials (4:8-9). The allotment can be viewed as a programming tool within claimant agencies since the allotment is an authorization to use specified quantities of controlled materials in the accomplishment of defense programs.

It is therefore the purpose of the Defense Materials System to insure that controlled materials are available to defense contractors, whereas the Defense Priorities System provides the means by which the total resource requirements of defense programs are satisfied.

Management Information Systems

Definition. From the preceding brief descriptions of the Defense Priorities and Defense Materials Systems, it should be apparent that the controlled materials requirements identified by JAMAC are of great significance within the Department of Defense. Accordingly, the management objectives of JAMAC include the need for efficient, error-free and timely manipulation of contractor prepared data. Moreover, as set-asides are established for the exclusive

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[2]The primary distinction between an Authorized Controlled Material Order and a rated order is that the former is used to specifically acquire controlled materials whereas a rated order is used to satisfy any material, other than controlled materials, or item requirement.

use of defense program needs, the accurate tabulation of contractor estimates is essential. It is to these ends that a management information system could be of important benefit.

At present there are numerous definitions of a management information system. These differing definitions stem from the relative newness of these systems and from differing opinions of their purpose and use. However, two main characteristics tend to be present in definitions of management information systems. First, management information systems are characterized by a shift toward the use of the computer for management applications; i.e., management information systems mark the attempt to bring the power of the computer to management. Secondly, management information systems attempt to provide information to both policy makers and operating management (2:13).

As such, information is stored and structured to serve the particular needs of management. The stored information then becomes the foundation of the system, its data base. In order for the data base to be responsive to management needs, the data must be organized into elements which can be synthesized into meaningful output (2:14).

For the purpose of this study, a management information system is defined as a management-oriented system. It is characterized by information elements

structured into a data base serving the information requirements of policy makers and operating management (2:14).

Planning and design. Similar to the numerous definitions of management information systems, the prerequisites and procedures of effective planning and designing abound. Advancing from the position of the stated definition, however, the following stages of development are considered to be essential:

> Stage 1: Systems Specification . . . includes the design of all of the aspects of a management information system that are important to the users. It includes principally the basic decisions as to what information should be provided by the system.
>
> Stage 2: Data-Processing Implementation . . . is concerned with those things that are important to the processing of the data. The purpose in this stage is to design a data-processing system that will most efficiently implement the system specified in Stage 1.
>
> Stage 3: Programming . . . starts with the systems flow charts and ends when the program is . . . (complete) [3:377-378].

Data Base Considerations

Generation. At the beginning of each calendar quarter, JAMAC prepares and forwards a notice to prime contractors requiring the use of controlled materials in the performance of defense contracts. A prime contractor is any organizational entity to which a defense contract is awarded to for performance by a government procuring activity. This definition does not include other organizational entities engaged in defense program performance by any other means.

The notice makes reference to and cites reporting requirements contained within Defense Materials System Regulation 1 and delineates specific reporting criteria. It is important to note that reporting is mandatory by virtue of federal statute and that failure to report can result in imprisonment or fine, or both (1).

Reporting by prime contractors covers a period of four calendar quarters composed of a future base quarter and three subsequent quarters. The base quarter is normally three calendar quarters in advance of the date of the notice (8:2).

In general, any prime contractor requiring controlled materials during the base and three subsequent quarters in excess of specific threshold amounts for any one of eight material classes is required to submit a Form DMS-4A, "Statement of Controlled Materials Requirements for Class 'A' Products--Production or Research and Development." The eight material classes are subsets of the four controlled materials (8:1-3).

Completed DMS-4A's depict all requirements for all eight material classes even though only one class may be in excess of threshold amounts. Prime contractors with material requirements under the thresholds may respond solely with a letter so stating and request exemption from reporting. The eight material classes and threshold amounts are (8:1-2):

Carbon Steel	10 tons
Alloy Steel	1 ton
Stainless Steel	1 ton
Copper and Copper-Base Alloy Brass Mill Products	1 ton
Copper Wire Mill Products	1 ton
Copper and Copper-Base Alloy Foundry Products and Powder	1 ton
Aluminum	1 ton
Nickel Alloys	1 ton

Reported material requirements are based solely on contracts already on-hand, contract add-ons, or follow-ons to contracts that the contractor is certain of receiving. Anticipated new contract awards are not included (8:2).

In addition to the DMS-4A, contractors are requested to complete a Format A, "DMS Requirements Forecast and Allotment Usage". The Format A depicts the contractors actual consumption of the eight material classes during the most recent calendar quarter (8:2).

Finally, in addition to the general reporting requirements, prime contractors in possession of "DX" rated contracts are required to submit a separate DMS-4A and Format A for each "DX" rated contract (8:3).

<u>Form and format</u>. The data on the DMS-4A and Format A forms (Figures 1 and 2) consists of forecasted material requirements for each of the four quarters and consumption rates for the most recent quarter. Moreover, it includes total requirements for each contractor as well as requirements for individual "DX" rated contracts. Material requirements and consumption for carbon steel and alloy

FORM DMS-4A
(REV. 9-76)

U.S. DEPARTMENT OF COMMERCE
DOMESTIC AND INTERNATIONAL BUSINESS ADMINISTRATION

DEFENSE MATERIALS SYSTEM

Statement of Controlled Materials Requirements for Class "A" Products – Production or Research and Development

This report is required by law (50 U.S.C. App. Sec. 2155). Failure to report can result in a maximum fine of $1,000 or imprisonment up to one year, or both. Information furnished herewith is deemed confidential pursuant to 50 U.S.C. App. Sec. 2155(e).

INSTRUCTIONS – Submit original and two (2) copies to Government Agency to which statement is made, and retain one (1) copy. Read instructions on reverse of this form before filling out this application.

1. Name and address of contractor *(Street, City, State, Zip Code)*

2. Name, address, title and telephone number of your company representative responsible for preparation of this form.

3. Control Number (For Agency Use)

4. Contracting Government agency

5. Government contract number(s) and date(s)

6. Name and address of Agency to which statement is submitted

Section I – SCHEDULE OF DELIVERIES ON RATED ORDERS *

Product (a)	Unit of measure (b)	Process Time (Mo.) (c)	Total Qty. (d)	___Qtr. 19___ (e)	___Qtr. 19___ (f)	___Qtr. 19___ (g)	___Qtr. 19___ (h)

Section II – CONTROLLED MATERIALS REQUIREMENTS *

Item No.	Controlled material (a)	Unit of measure (b)	Item No. (c)	Total (d)	___Qtr. 19___ (e)	___Qtr. 19___ (f)	___Qtr. 19___ (g)	___Qtr. 19___ (h)
10	Carbon steel *(including wrought iron)*	Short tons						
20	Alloy steel *(except stainless steel)*							
30	Stainless steel	Pounds						
40	Copper and copper-base alloy brass mill products							
50	Copper wire mill products							
60	Copper and copper-base alloy foundry products and powder							
70	Aluminum							
80	Nickel alloys							

FOR GOVERNMENT USE ONLY

* Use continuation sheet if required for more than four quarters.

USCOMM-DC 69757-P76

Figure 1 FORM DMS-4A

"FORMAT A"

DMS REQUIREMENTS FORECAST AND ALLOTMENT USAGE

BOB APPROVAL NO. 22-R0299

(1) NAME AND ADDRESS OF FACILITY	(2) NAME AND PHONE NUMBER OF OFFICIAL RESPONSIBLE FOR REPORT	(3) PROCURING SERVICE	(5) DATE OF REPORT
		(4) PROGRAM SYMBOL	(6) CALENDAR QUARTER QTR 19

(7) CHECK APPROPRIATE BLOCK Requirements Forecast ☐ Allotment Usage ☐	(8) Item 10 Carbon Steel Tons	(9) Item 20 Alloy Steel Tons	(10) Item 30 Stainless Steel Lbs	(11) Item 40 Brass Mill Products Lbs	(12) Item 50 Copper Wire Lbs	(13) Item 60 Copper Foundry Lbs	(14) Item 70 Aluminum Lbs	(15) Item 80 Nickel Alloys Lbs
(16) PRODUCTION MODEL AND CONTRACT NUMBER								
(17) SUB-TOTAL								
(18) SPARES								
(19) TOOLING								
(20) RESEARCH AND DEVELOPMENT								
(21) MODIFICATION								
(22) CIVIL AIR CARRIER								
(23) TOTAL								

Figure 2

FORMAT A

steel are reported in short tons while the remaining six classes are reported in pounds (1).

Retention requirements. Although JAMAC's responsibility for reporting total estimated material requirements would tend to create the impression that only consolidated material requirements are retained, other functional responsibilities of JAMAC require that all data collected be retrievable in numerous format. It is therefore mandatory that all collected data be retained by individual quarterly reports and be retained in such a manner that various types of data manipulation are possible (1).

Summary

The Defense Materials System provides the means whereby the availability of controlled materials required by defense contractors to manufacture defense items is insured. The process of establishing set-asides and receiving allotments secures a portion of the productive output of controlled materials producers for procuring defense or "associated" agencies.

Within the DOD, JAMAC is responsible for the submission of estimated controlled material requirements to the Federal Preparedness Agency. Since the set-aside amount is based on cumulative material requirements and allotments to claimant agencies specify quantities of controlled materials available for defense programs, the

development of a management information system could be of significant benefit to JAMAC.

The planning and design of a management information system is accomplished in three stages of effort. Formal definition of management information systems and systems specification require that planning and design be accomplished in light of the information requirements and desires of management. Upon complete systems specification, remaining effort is accordingly directed toward the actual realization of management's desires.

Chapter 3

METHODOLOGY

Given that the planning and design of a management information system is accomplished in three stages of effort and that the pragmatic orientation of this research effort engendered three product oriented objectives, it follows that the methodology must encompass the stages of effort and product oriented objectives. The purpose of this chapter is to describe the methodology which encompassed a systematic project directed toward the creation of a management information system.

Project Development

As specified during the definition of a management information system, information is stored and structured to serve the needs of management. Additionally, the stored information, or collected data, must be organized into elements which can be synthesized into meaningful output. In recognition of JAMAC's responsibilities and information requirements, it was apparent that all collected data must be stored in individual quarterly report records capable of being retrieved in a manner which would facilitate numerous variations of data manipulation.

It was to this end that a project was designed centering around three prime considerations. The prime considerations were the: (1) exact specification of information requirements, (2) development of control and audit safeguards to insure system validity, and (3) specification of performance criteria to measure operational performance. The following outlines the rationale and purpose of the three considerations.

Information requirements. Those responsibile for system design require complete definition of the information requirements of the management information system in order to structure the data base. Management must state their information requirements so that the information elements incorporated into the data base will reflect the stated requirements. Unless the information requirements of the system are stated correctly and completely, the operational system will be unresponsive to their needs.

Additionally, relationships between the information elements in the data base must be defined. The data base must be structured, based on these relationships, to permit information retrieval. Unless the relationships between information elements are correctly defined, the final system will not be responsive to user interrogations.

An improperly designed data base will prevent the efficient and effective operation of a management

information system as the data base is the center of the system. Improper design is the result of inadequate definition of information requirements and information relationships. In short, a data base can be developed only if system requirements are clearly defined.

Control and audit safeguards. Controls must be established to prevent errors from affecting the data base. Errors are most likely to occur during the process of entering data into or updating the data base. Such errors must be stopped before entering the data base.

All transactions that affect the data base must be checked for validity and accuracy. Errors must be located and corrected before output validity is damaged. Error detection procedures must be an integral part of the operational management information system.

Additionally, information in the data base must be accessible in order to verify that the information is correct. If it is not correct, audits must locate the discrepancies within the data base. Therefore, provisions must be established which permit periodic audit of information within the data base.

Error-detection and audit controls serve to validate the integrity of the management information system. A management information system cannot work properly unless the information in the data base is protected from errors.

Performance criteria. Criteria must be established to measure the performance of the management information system. In other words, objectives must be established for the system to meet or exceed.

The objectives of the management information system in reality specify the reason for the creation of the system. As discussed earlier, such objectives may include the faster production of required information, improved accuracy of material requirements, and the release of assigned personnel to pursue more meaningful tasks.

Without system performance criteria, system operation cannot be evaluated. Performance evaluation requires the existence of standards by which to measure actual performance.

Project Implementation

From the preceding discussion, a definite requirement exists to directly involve the users of the management information system, i.e., operating and policy management, in system design. The design characteristics specified by the users determines the shape and extent of system performance as well as its effectiveness. Project implementation, then, begins with user specification of the system and progresses through each stage of design effort.

System specification. To achieve complete and accurate definition of the management information system, an

interview guide in the form of a checklist was used during interviews with JAMAC representatives. Each question within the checklist was derived to aid the clear understanding of JAMAC's desires as well as to provide the means to satisfy the three research objectives. The checklist questions are:

1. What are the objectives of the management information system?

2. What are the information requirements of the management information system? Which of the stated requirements are of vital interest?

3. What are the file-creation and maintenance requirements of the system?

4. What are the file-searching and analysis needs of the system users?

5. What output is required from the management information system? What are the form and content of this output?

6. What control and audit procedures can be established to insure validity of system operation? How complete should the control and audit procedures be? How frequently should control and audit procedures be accomplished?

7. What are the performance criteria of the management information system?

Data processing implementation. Following the system specification stage, i.e., definition of management

information system requirements, effort was directed to translating the requirements into a data-processing algorithm capable of achieving the system specifications.

Detailed analysis and planning was accomplished to achieve the translation of the system requirements into a workable algorithm. To achieve this goal, the following considerations were reduced to a checklist format.

1. Has the format of the information elements in the data base been defined and described? Does JAMAC concur with the descriptions?

2. What relationships exist between the information elements in the data base? How can the data base be structured to capitalize on the relationships?

3. How can the data base be structured to be adaptable to the file-creation and maintenance requirements of the system?

4. What techniques can be used to accomplish file-searching and analysis?

5. How must the data base be structured to achieve satisfaction of information requirements?

<u>Programming</u>. Upon completion of the preceding two stages, a data base structure composed of information elements was defined. Effort was then directed to preparing a program which would manipulate the appropriate information elements to yield required information. All programming effort was accomplished using FORTRAN Y via the CREATE System and

time-sharing terminals located in the School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB, Ohio.

Data was provided by JAMAC in order to pursue operational and system validity testing. Data was supplied by means of recent DMS-4A forms and test program runs were compared with previously calculated figures to confirm the accuracy of the program.

Summary

The methodology consists of three distinct phases or stages of effort. Each stage of effort is directly linked to the research questions and objectives of the research effort. By reducing the overall thesis effort to a three phased project, intensive effort is directed to each phase in a sequential manner thus reducing the possibility of failing to address significant aspects of the planning and design effort.

To further preclude the possibility of accidental oversight, each stage of effort is guided by a checklist of analytical questions. Each checklist is designed to assure that the objectives of each phase is attained. The three stages of effort include system specification by the user, data processing implementation by the system designers, and programming of the designed system.

Three primary design considerations guided the development of the project. The considerations included

the exact specification of information requirements by the users, the need to establish control and audit procedures to insure system validity, and the specification of performance criteria to measure the operational performance of the system.

Chapter 4

RESULTS OF THE PROJECT

The purpose of this chapter is to describe the results of the project developed to plan and design the management information system. The chapter will specifically address the results of the system specification, data processing implementation, and programming stages of development.

System Specification

Project implementation began with system specification interviews conducted on a personal interview basis with four selected individuals: Mr. W. W. Wetterling, Civilian Administrator, JAMAC; Mr. John Cantrell, Industrial Specialist, JAMAC; Mr. John Horseman, Industrial Specialist, JAMAC; and Mr. Robert Morris, Industrial Specialist, JAMAC. These individuals were identified by Mr. Wetterling in recognition of their functional responsibilities in relation to the reporting of controlled materials requirements to the Federal Preparedness Agency. All interviews were conducted within JAMAC's assigned office space located in Building #16, Area B, Wright-Patterson AFB, Ohio.

System objectives. During each calendar quarter, after receipt of Form DMS-4A and Format A reports, JAMAC must prepare and forward controlled materials estimates to the Federal Preparedness Agency. In addition to reporting the estimated materials requirements of a large number of participating contractors, the estimated quantities must be reported in seventy-three specific sub-classifications of the four controlled materials.

The process of reducing the large volume of data to reportable format represents a tremendous drain of manpower resources as the process is performed manually. A computer program does exist to assist in this effort, however, its capabilities are severely limited. Due to logic errors and a basic inability to produce results compatible with JAMAC's reporting requirements, the program is primarily used to store peripheral data and to validate manually computed totals of the eight reported material classifications.

Mr. Wetterling accurately defined the objectives of the management information system while addressing the need for data automation within JAMAC (7). The existence of such a system would enable JAMAC personnel to pursue more productive and meaningful tasks and reduce the amount of time expended performing clerical tasks. More specifically stated, the system's objectives include the faster production of required information, the production of

accurate material forecasts, and the release of assigned personnel to pursue other tasks.

Information requirements. As a result of each interview with JAMAC representatives, a lengthy list of requirements evolved. Time constraints, however, limited the capability of the system designers to comply with all of the requirements. JAMAC was requested to specify which of the requirements was most desired.

After discussion, Mr. Wetterling (7) specified that the effort was to concentrate on the development of a system capable of generating information output compatible with DD Form 614, "Materials Requirements-Steel and Nickel Alloys" and DD Form 614-1, "Materials Requirements-Copper and Aluminum". The two forms (Figures 3 and 4) are the primary instruments used by JAMAC to report materials estimates to the Federal Preparedness Agency.

Information requirements were further delimited to include United States Air Force responsibilities contained within program identification codes A-1, A-2, A-6, A-7, C-2, C-3, and C-9 (1). Air Force contracts awarded to contractors within each program identification code are:

A-1 . . . . . . Aircraft

A-2 . . . . . . Missiles

A-6 . . . . . . Ammunition

A-7 . . . . . . Electronic and communications equipment

MATERIALS REQUIREMENTS STEEL AND NICKEL ALLOYS	REPORTING AGENCY	PROCUREMENT (Claimant) PROGRAM	REPORT CONTROL SYMBOL
			JOB NUMBER / DATE

DD CODE a	ITEM DESCRIPTION[1] b	TOTAL FOR QUARTERS c	QUARTER C.Y. d	QUARTER C.Y. e	QUARTER C.Y. f	QUARTER C.Y. g
		(Short Tons)	*(Short Tons)*	*(Short Tons)*	*(Short Tons)*	*(Short Tons)*
1200	*CARBON STEEL (Incl Wr. Iron) TOTAL*					
1211	CASTINGS					
1212	INGOTS, BILLETS, ETC. *(Excl. 1215)*					
1218	BILLETS, STOCK FOR SHELL BODIES					
1221	BARS, COLD FINISHED					
1222	BARS, HOT ROLLED *(Excl. 1223 + 1225)*					
1225	BARS, REINFORCING					
1225	BARS, STOCK FOR SHELL BODIES					
1251	STRUCTURAL SHAPES					
1252	PILING					
1240	PIPE & TUBING, INCL. THRD. CPLGS.					
1281	PLATES					
1252	SHEET AND STRIP *(Excl. 1261)*					
1261	SHEET, GALVANIZED					
1262	TIN, TERNE, TIN MILL BLACK PLATE					
1270	RAILS AND TRACK ACCESSORIES					
1280	WHEELS, TIRES AND AXLES					
1290	WIRE RODS, WIRE AND WIRE PROD.					
1500	*ALLOY STEEL (Excl. 1000 & 1400) TOTAL*					
1511	CASTINGS *(Excluding armor)*					
1512	INGOTS, BILLETS, ETC.					
1514	CASTINGS, ARMOR					
1521	BARS, COLD FINISHED					
1522	BARS, HOT ROLLED					
1551	STRUCTURAL SHAPES					
1540	PIPE & TUBING, INCL. THRD. CPLGS.					
1381	PLATES *(Excluding 1355)*					
1582	SHEET AND STRIP					
1555	PLATES, ROLLED ARMOR					
1570	TRACK ACCESSORIES					
1580	WHEELS, TIRES AND AXLES					
1590	WIRE RODS, WIRE AND WIRE PROD.					
		(M Pounds)	*(M Pounds)*	*(M Pounds)*	*(M Pounds)*	*(M Pounds)*
1000	*STAINLESS STEEL - NON-NICKEL BEARING - TOTAL*					
1400	*STAINLESS STEEL - NICKEL BEARING - TOTAL*					
0600	*NICKEL ALLOYS - TOTAL*					
0601	5% THRU 29.9% NICKEL CONTENT					
0602	30% THRU 49.9% NICKEL CONTENT					
0603	50% THRU 100% NICKEL CONTENT					

[1]*Detailed item definitions are given in the "Coded List of Materials", 1 Aug 1956, issued pursuant to DOD Instruction 4210.1*

Figure 3 DD Form 614

MATERIALS REQUIREMENTS COPPER AND ALUMINUM	REPORTING AGENCY	PROCUREMENT (Claimant) PROGRAM	REPORT CONTROL SYMBOL	
			JOB NUMBER	DATE

DO CODE a	ITEM DESCRIPTION[1] b	TOTAL FOR QUARTERS c	QUARTER C.Y. d	QUARTER C.Y. e	QUARTER C.Y. f	QUARTER C.Y. g
		(M Pounds)	(M Pounds)	(M Pounds)	(M Pounds)	(M Pounds)
1510	*BRASS MILL COPPER BASE ALLOY PRODUCTS - TOTAL*					
1511	PLATE, SHEET AND STRIP (Except 1514)					
1512	RODS, BARS AND WIRE					
1513	TUBE AND PIPE					
1514	AMMO CUPS AND DISCS					
1520	*BRASS MILL UNALLOYED COPPER PRODUCTS - TOTAL*					
1521	PLATE, SHEET AND STRIP					
1522	RODS, BARS AND WIRE					
1523	TUBE AND PIPE					
1510 + 1520	*BRASS MILL PRODUCTS - TOTAL* (Sum Lines 1510 and 1520)					
1530	*WIRE MILL PROD* (Cu Content)					
1540	*FOUNDRY PRODUCTS*					
1550	*POWDER - TOTAL*					
1551	POWDER, COPPER, UNALLOYED					
1552	POWDER, COPPER BASE ALLOYS					
1600	*ALUMINUM - TOTAL*					
1610	RODS AND BARS, PORCELAIN COATED					
1611	RODS AND BARS, ROLLED (Excl. 1610 & 1612 & Excl. stock for 1620, 1630 & 1641)					
1612	RODS AND BARS, ROLLED, FORGING AND IMPACT EXTRUSION STOCK					
1620	WIRE AND CABLE (Excl. 1630)					
1630	RIVETS AND RIVET WIRE					
1641	SAND CASTINGS					
1642	MOLD CASTINGS					
1643	DIE CASTINGS					
1644	OTHER CASTINGS					
1661	SHAPES, ROLLED STRUCTURAL					
1662	SHAPES, EXTRUDED (Excl. 1563 & 1664)					
1663	SHAPES, EXTRUDED FORGING STOCK					
1664	SHAPES, EXTRUDED, PORCELAIN COATED					
1670	SHEET, STRIP & PLATE (Excl. 1671 & stock for 1693)					
1671	SHEET, STRIP & PLATE, PORCELAIN COATED					
1680	TUBING					
1691	POWDER					
1692	INGOT					
1693	FOIL (.005" and thinner)					

[1] Detailed item definitions are given in the "Coded List of Materials", 1 Aug 1956, issued pursuant to DOD Instruction 4210.1

Figure 4 DD Form 614-1

C-2 . . . . . . Department of Defense construction

C-3 . . . . . . Maintenance, repair and operating supplies (MRO) for Department of Defense facilities

C-9 . . . . . . Miscellaneous

<u>File-creation and maintenance</u>. File creation and maintenance requirements are such that JAMAC must maintain the flexibility to prepare estimated material requirements reports on a cummulative basis of all reporting contractors as well as to perform analysis on individual contractors or specific material requirements on a case-by-case basis (1). This requirement creates a need for file creation and maintenance on an individual contractor basis per reporting period.

Further, each contractor file must be capable of being updated on a quarterly basis. Updating of contractor files on a periodic basis creates the need to have access to each contractor file. However, in any given quarter should a contractor not be required to submit material requirement reports, existing reports on-hand for that contractor are to be carried forward as if a new report was received. The amount carried forward are those amounts portrayed beyond past base quarters which are compatible with the current reporting quarter (1). This creates a need for the capability to selectively carry forward reported estimates already in that contractor's file.

File-search and analysis. From the preceding, some means to locate each contractor's file must exist. The need for such a requirement stems from requests to analyze specific contractor's requirements, requests for information regarding specific materials needs, or to update contractor files due to non-required response in accordance with established reporting criteria (1).

System output. Having defined system output in general terms, i.e., information compatible with DD Forms 614 and 614-1 for seven specified programs, specific requirements in terms of output content and format were established. Content and format requirements were established by Mr. Cantrell and Mr. Morris during interviews conducted from 17 November 1977 to 26 April 1978.

Contractor reported material requirements are assigned internal control numbers by JAMAC upon establishment of contractor records. Contractor records are established upon initial receipt of Form DMS-4A reports. Each control number consists of nineteen digits for each of the seven possible program identification codes a contractor may report under. In short, one contractor may be assigned as many as seven control numbers should that contractor be reporting controlled materials requirements for each of the seven program identification codes. Contractor reports and control numbers are retired when that contractor no longer reports requirements to JAMAC.

Controlled material requirements output, then, is to consist of the following format and content. Output will be segregated by program identification code groupings. Within each program group, system output will portray materials requirements for each of the seventy-three sub-classifications of material on the DD Forms 614 and 614-1. Each sub-classification amount will be displayed to the nearest hundredth.

Control and audit procedures. In conjunction with basic system output requirement definition, means to control and audit data input was established. System output is to include a current contractor address list with associated control numbers and factor matrices for each program for verification of accuracy. Within each program group, a listing which consists of three data elements is also output. These data elements consist of the assigned control number, reported controlled materials amounts, and column totals for the four quarters of projected materials requirements.

The combination of system output and the means to verify the accuracy of input data will enable the user to compare hard copy DMS-4A reports to system output for keypunch errors and to perform external accuracy audits.

Data Processing Implementation

The data processing implementation stage represents an attempt to translate requirements levied during system specification into a data processing algorithm. In short, this stage represents a conceptual process of reducing system specification and data base requirements to a format capable of computer programming.

Information elements. Information elements contained in the data base consist of pertinent information extracted from DMS-4A forms required to meet system output and control and audit procedures specified by JAMAC. Specifically the elements include, for each contractor, the contractor control number, the contractor's name and address, eight material classification amounts for four quarters, and seven factor matrices.

The factor matrices consist of eighty-one cells which contain factor constants by which material requirements totals can be manipulated by matrix algebra to yield the seventy-three material sub-classifications displayed on DD Forms 614 and 614-1. Appendix B contains a complete listing of each factor constant by applicable program.

For clarification purposes, the item numbers correspond to the eight reported materials requirements reported on DMS-4A forms and the DD codes correspond to each material sub-classification displayed on DD Forms 614

and 614-1. Each factor constant represents the proportional amount of each item number. The displayed factor constants are the result of statistical techniques performed by JAMAC and were provided by JAMAC for incorporation within the program.

Data base structure. As each information element requires strict segregation by contractor file and program identification code, information element integrity must be strictly maintained. Therefore, each contractor file within applicable program codes must be entered and maintained in the data base on a singular basis.

In view of output requirements, the data base must be structured such that all information contained therein are read and subsequently totalled during each computer run. This, in turn, requires a data base of large size. Similarly, the individual reading and storage of each information element during computer processing requires larger than normal core capacity.

Programming

The computer program was written in FORTRAN Y computer programming language and was developed for operation on a Honeywell 635 computer located in the Air Force Logistics Command Headquarters Building at Wright-Patterson AFB. Since the computer program was written in

FORTRAN Y, it should be easily adapted to other computer systems which accept FORTRAN based language programs.

The Honeywell 635 computer has three modes of operation available to the user for running computer programs; (1) Time-Share over a teletypewriter, (2) BATCH by use of the CARDIN option over a teletypewriter, and (3) straight BATCH. The program evolved from the first two operation modes and was ultimately converted to a straight BATCH processing program using automatic data processing cards as an input medium.

Program development by use of Time-Share was pursued for two principal reasons. First, Time-Share permits all preliminary programming to be accomplished by teletypewriter. Second, conversion of a Time-Share program to CARDIN requires programming format and syntax identical to BATCH processing. Both modes of operation eliminate the need for automatic data processing card preparation and permit simplified correction of errors by providing instant diagnostics and teletypewriter input medium. Both programs make use of the same logic and priority of routines and with the exception of simple format and syntax modifications are essentially the same program. The same distinction holds true for the BATCH processing program.

The Time-Share program, the first developed, was tested for accuracy and compliance with system specifications using simulated data. After making appropriate

corrections, the program was modified for CARDIN use. The CARDIN program was tested using actual data provided by JAMAC. The program was then modified for compatibility with BATCH processing.

Appendix C describes the computer program that was developed to satisfy the information requirements specified by JAMAC. The logic and sequence of operations are described by external and internal program documentation.

Summary

The management information system specified by JAMAC must generate output compatible with the form and content of DD Forms 614 and 614-1. The seventy-three material requirements sub-classifications are to be produced for program identification codes A-1, A-2, A-6, A-7, C-2, C-3, and C-9.

Within each program identification code, system output is to be a mixture of control and audit data as well as specific material sub-classification quantities. Specifically, system output will consist of the name and address of each contractor reporting to JAMAC, the assigned contractor control number, material requirement amounts reported by each contractor, a column total of quarterly amounts reported by each contractor, the computed matrix of program data which is compatible with DD Forms 614 and 614-1, material sub-classification requirements quantities, and a grand total of all reported amounts.

The structure of the data base requires more than normally alloted core capacity during computer processing. The need for expanded core capacity is the result of the manner in which data must be entered and stored within the data base.

Chapter 5

RESULTS AND RECOMMENDATIONS

The purpose of this chapter is to describe the results of the thesis effort in relation to JAMAC's stated objectives and to identify recommended areas for follow-on thesis efforts. The recommendations presented are areas of concern to JAMAC in which an interest for future thesis effort was expressed.

Thesis Effort Results

The research problem was to plan and design a management information system to consolidate and synthesize materials requirement estimates for JAMAC. The program developed will consolidate and synthesize the estimates in a form compatible with JAMAC's reporting requirements. Specifically, system output provides the seventy-three materials sub-classification amounts compatible with the form and content requirements of DD Forms 614 and 614-1.

System objectives included the faster production of required information, the production of accurate material forecasts, and the release of JAMAC personnel to pursue more productive and meaningful tasks. The program developed will accomplish all three objectives. It will eliminate the need for the manual manipulation of data and

provide accurate material forecasts. These accomplishments will enable JAMAC personnel to pursue other tasks by reducing the amount of time required to prepare required reports.

The specific information requirement of the management information system was to generate information compatible with DD Forms 614 and 614-1 for seven program identification codes. The use of matrix algebra functions within the program generates the seventy-three materials sub-classification amounts contained in the forms. Moreover, the sub-classification amounts are generated for each of the seven programs.

System output was to contain the means whereby the accuracy of input data could be subject to control and audit procedures. The generation of input data lists and column totals of each input data set enables the verification of input data accuracy and to perform external accuracy audits.

Recommendations for Future Study

The responsibilities of JAMAC provide a fertile area for future thesis efforts. Specific management problems requiring in-depth study and analysis occur on a periodic basis. A requirement also exists for further automation of reporting requirements and management areas. The following recommendations center on automation aspects.

Concern exists regarding the accuracy of contractor estimates as submitted on DMS-4A forms. A study in this area should attempt to compare Format A reports of consumption with DMS-4A estimates. Such a study might explore the feasibility of planning and designing a variance analysis computer program. The program should have the capability of comparing Format A and DMS-4A reports from an established data base. Variance analysis would identify variances beyond a specified order of magnitude and identify those contractors exceeding reasonable variance limits. Identification of excessive variance amounts would indicate poor materials estimating techniques and procedures.

Another area that might be pursued is to automate other reports prepared by JAMAC. One such report is the Manufacturer's Report. This effort would study the feasibility of adding to this program or the planning and designing of another program.

Finally, a cost-benefit study to evaluate the feasibility and the creation of real-time computer support of JAMAC's operations is suggested. Such a study would provide the means whereby JAMAC could provide instantaneous response to specific inquiries relating to controlled materials requirements and consumption and the control of exotic materials under the purview of JAMAC.

APPENDIX A

DEFENSE PROGRAMS COVERED BY THE DEFENSE PRIORITIES AND THE DEFENSE MATERIALS SYSTEMS

Program identification	Program	Defense Agency
	For Department of Defense and associated programs:	
A-1	Aircraft	
A-2	Missiles	
A-3	Ships	Department of Defense:
A-4	Tank-automotive	Army, Navy (including
A-5	Weapons	Coast Guard), Air Force,
A-6	Ammunition	Defense Supply Agency,
A-7	Electronic and communications equipment	associated agencies of
B-1	Military building supplies	Department of Defense:
B-8	Production equipment (for defense contractor's account)	Central Intelligence Agency, Federal
B-9	Production equipment (Government-owned)	Aviation Administration,
C-2	Department of Defense construction	and National Aeronautics
C-3	Maintenance, repair and operating supplies (MRO) for Department of Defense facilities	and Space Administration.
C-8	Controlled materials for Defense Industrial Supply Center (DISC)	
C-9	Miscellaneous	
	For U. S. Energy Research & Development Administration:	
E-1	Construction	
E-2	Operations-including maintenance, repair and operating supplies (MRO)	U. S. Energy Research & Development
E-3	Privately owned facilities	Administration.
	For other Defense, Atomic Energy and related programs:	
B-5	Certain self-authorizing consumers (see sec. 7 (d) of DPS Reg. 1	
C-4	Certain munitions items purchased by friendly foreign governments through domestic commercial channels for export	Bureau of Domestic

C-5	Canadian military programs	
C-6	Certain direct defense needs of friendly foreign governments other than Canada	
D-1	Controlled materials producers	
D-2	Approved State and local civil defense programs ...	
D-3	Further converters (steel)	
D-4	Private domestic production	
D-5	Private domestic construction	
D-6	Canadian production and construction	
D-7	Friendly foreign nations (other than Canada) Production and construction	
D-8	Distributors of controlled materials	Bureau of Domestic Commerce
D-9	Maintenance, repair and operating supplies (MRO) (see Dir. 1 to DMS Reg. 1)	
E-4	Canadian atomic energy program	
K-1	General Services Administration's supply distribution facility program	
AM	Aluminum controlled materials producers	
AM-9000..	Aluminum controlled materials distributors	
FC	Further converters (steel and nickel alloys)	
F-1	Certain items sponsored by the Federal Energy Administration for and related to construction of the Trans-Alaska Pipeline	
F-2	Certain items sponsored by the Federal Energy Administration for and related to the development of Alaskan North Slope oil resources	Department of the Interior

(4:6)

APPENDIX B

FACTOR CONSTANTS TO DETERMINE MATERIAL REQUIREMENTS FOR PROGRAM IDENTIFICATION CODES A-1, A-2, A-6, A-7, C-2, C-3, AND C-9

A-1 PROGRAM

ITEM	DD CODE	FACTOR
10	1200	1.000
	1212	.084
	1221	.461
	1240	.008
	1251	.286
	1252	.124
	1290	.037
20	1300	1.000
	1312	.462
	1321	.029
	1322	.445
	1340	.029
	1351	.017
	1352	.018
30	1000	.463
	1400	.537
40	1510	.959
	1511	.063
	1512	.902
	1520	.041
	1521	.041

ITEM	DD CODE	FACTOR
50	1530	1.000
60	1540	1.000
70	1600	1.000
	1611	.009
	1612	.094
	1620	.001
	1651	.013
	1652	.001
	1661	.045
	1662	.165
	1663	.037
	1670	.537
	1671	.086
	1680	.007
	1692	.002
	1693	.003
80	0600	1.000
	0601	.050
	0602	.461
	0603	.489

A-2 PROGRAM

ITEM	DD CODE	FACTOR
10	1200	1.000
	1212	.115
	1221	.193
	1222	.043
	1231	.037
	1232	.069
	1240	.201
	1251	.094
	1252	.205
	1290	.043
20	1300	1.000
	1312	.375
	1321	.036
	1322	.321
	1331	.021
	1340	.021
	1351	.068
	1352	.146
	1380	.012
30	1000	.268
	1400	.732
40	1510	.508
	1511	.125
	1512	.258
	1513	.125
	1520	.492
	1521	.117
	1522	.258
	1523	.117

ITEM	DD CODE	FACTOR
50	1530	1.000
60	1540	1.000
70	1600	1.000
	1611	.068
	1612	.062
	1620	.011
	1651	.019
	1652	.016
	1653	.011
	1654	.011
	1661	.011
	1662	.075
	1670	.224
	1680	.019
	1691	.445
	1692	.016
	1693	.012
80	0600	1.000
	0601	.204
	0602	.204
	0603	.592

A-6 PROGRAM

ITEM	DD CODE	FACTOR
10	1200	1.000
	1212	.031
	1221	.055
	1252	.914
20	1300	1.000
	1331	.300
	1340	.700
30	1000	.802
	1400	.198
40	1510	.733
	1512	.733
	1520	.267
	1521	.067
	1522	.067
	1523	.133
50	1530	1.000
60	1540	1.000
70	1600	1.000
	1611	.270
	1651	.175
	1670	.183
	1680	.372
80	0600	1.000

A-7 PROGRAM

ITEM	DD CODE	FACTOR
10	1200	1.000
	1221	.072
	1222	.072
	1240	.133
	1252	.615
	1290	.108
20	1300	1.000
	1321	.586
	1340	.099
	1351	.216
	1352	.099
30	1000	.51
	1400	.49
40	1510	.511
	1511	.057
	1512	.401
	1513	.053
	1520	.489
	1521	.070
	1522	.384
	1523	.035
50	1530	1.000
60	1540	1.000
70	1600	1.000
	1611	.001
	1612	.005
	1620	.004
	1651	.001
	1652	.003
	1653	.003
	1654	.001
	1662	.001
	1670	.017
	1680	.002
	1693	.962
80	0600	1.000
	0601	.224
	0602	.612
	0603	.164

C-2 PROGRAM

ITEM	DD CODE	FACTOR
10	1200	1.000
	1223	.110
	1231	.485
	1240	.055
	1251	.141
	1252	.087
	1261	.005
	1262	.007
	1290	.110
20	1300	1.000
	1322	.103
	1340	.552
	1352	.345
30	1000	.406
	1400	.594
40	1510	.596
	1511	.110
	1512	.075
	1513	.411
	1520	.404
	1521	.110
	1522	.075
	1523	.219

ITEM	DD CODE	FACTOR
50	1530	1.000
60	1540	1.000
70	1600	1.000
	1670	.767
	1680	.233
80	0600	1.000

C-3 PROGRAM

ITEM	DD CODE	FACTOR
10	1200	1.000
	1221	.046
	1223	.091
	1231	.343
	1240	.198
	1251	.068
	1252	.068
	1261	.057
	1262	.049
	1270	.019
	1290	.061
20	1300	1.000
	1321	.630
	1340	.370
30	1000	.978
	1400	.022
40	1510	.889
	1511	.037
	1512	.037
	1513	.519
	1514	.296
	1520	.111
	1521	.037
	1522	.037
	1523	.037

ITEM	DD CODE	FACTOR
50	1530	1.000
60	1540	1.000
70	1600	1.000
	1612	.701
	1620	.299

C-9 PROGRAM

10	1200	1.000
	1240	.789
	1251	.211
20	1300	1.000
	1312	1.000
30	1000	1.000
40	1510	1.000
	1513	1.000

50	1530	1.000
60	1540	1.000
70	1600	1.000
	1661	.716
	1662	.284

APPENDIX C

COMPUTER PROGRAM DOCUMENTATION

The purpose of this appendix is to describe the computer program that was developed to satisfy the information requirements specified by JAMAC. Each section of the program is described with the use of detailed listings of the coded program. Finally, the method for running the computer program is discussed.

Program Description

The following seven sections describe the operation of the program. The program was divided into seven sections for discussion on the basis of the primary function performed by each section.

Section 1. The program is initialized by an access statement (*#RUN *=(ULIB)GRADLIB/TSS,R) which is used to gain access to routines used by the program. Specifically, access is gained to the Air Force Institute of Technology program library which contains the matrix alegebra routines used to compute the seventy-three materials sub-classification quantities.

Five function calls are obtained by the access statement. These include MATREAD, MATWRITE, MATINIT, MATADD, and MATMULT. Each function call, when used, must be in a format compatible with the accessed program.

The MATREAD function call is used to read values into a specified matrix from a file. The format of the

function call is MATREAD (NAME, ROW, COL, FILE, RSTART, RSTOP, CSTART, CSTOP, FMT) where:

NAME	=	the name of the matrix which data values are to be read into,
ROW	=	the number of rows in NAME,
COL	=	the number of columns in NAME,
FILE	=	the file code of the data file to be read,
RSTART	=	the beginning row in NAME to receive values,
RSTOP	=	the ending row in NAME to receive values,
CSTART	=	the beginning column in NAME to receive values,
CSTOP	=	the ending column in NAME to receive values, and
FMT	=	the format to be used.

MATWRITE function calls write values of a specified matrix (NAME) to a file (FILE). The format of the MATWRITE call is MATWRITE (NAME, ROW, COL, FILE, RSTART, RSTOP, CSTART, CSTOP, FMT).

The MATADD function call is used to add two matrices in the form: [C] = [A] + [B]. The format of MATADD is MATADD (A, ROW, COL, B, C) where:

A	=	the name of the matrix whose data values are to be added to B,
ROW	=	the number of rows in each matrix,
COL	=	the number of columns in each matrix,
B	=	the name of the matrix to be added to A, and
C	=	the name of the resulting matrix.

MATMULT performs scalar multiplication of two matrices. The format of the MATMULT call is MATMULT (MNAME, MROW, MCOL, FACTOR, RSTART, RSTOP, CSTART, CSTOP, 0) where:

MNAME = the name of the matrix to be used as the multiplicand,

MROW = the number of rows in MNAME,

MCOL = the number of columns in MNAME,

FACTOR = the scalar multiplier,

RSTART = the first row of MNAME to be used,

RSTOP = the last row of MNAME to be used,

CSTART = the first column of MNAME to be used,

CSTOP = the last column of MNAME to be used, and

0 = the argument which specifies scalar multiplication.

Lastly, the function call MATINIT initializes all cells of a specified matrix to an assigned value. The format of this function call is MATINIT (NAME, ROW, COL, VALUE, RSTART, RSTOP, CSTART, CSTOP) where the variable names are as previously defined and VALUE is the initialized value. A complete listing of the accessed program is contained in Appendix D.

Next, an overview of the program is provided in the program statements for use by others performing work with or on the program. The overview and subsequent program documentation will enable that person to quickly familiarize himself with the program and its logic. The overview

consists of a purpose statement, a performance statement, and a listing and description of the variable names used within the program. A detailed description of each variable name and its function will occur within the following sections as appropriate. An understanding of how the files and arrays are constructed is a prerequisite for manipulating the program. A listing of section 1 is displayed in Figure 5.

Section 2. Section 2 begins with a documentation statement (Figure 6) immediately followed by four declarative statements. The declarative statements direct the computer to establish storage space on its current file. Storage space is thereupon established in matrix format in the following manner. The words REAL and CHARACTER specify the type of data to be stored and how that data is to be interpreted by the computer. REAL specifies that the data to be stored are numeric characters and that the characters are to be treated as real numbers. The word CHARACTER specifies that alphabetic and/or numeric characters are to be stored but that all entries are to be treated as alphabetic characters. The size of each matrix is established by the numbers enclosed within parentheses following each variable name.

For example, as the computer reads across the first declarative line it will establish a matrix entitled DATA.

```
10*#RUN *=(ULIB)GRADLIB/TSS,R
20C THE FOLLOWING PROGRAM IS DESIGNED TO MANIPULATE DATA RECEIVED BY THE
30C JOINT AERONAUTICAL MATERIALS ACTIVITY(JAMAC) PER REPORTING RQMTS
40C ESTABLISHED BY AND FOR THE DEFENSE MATERIALS SYSTEM (DMS).  THE
50C PROGRAM WILL MANIPULATE DATA OF THE FORM AND CONTENT OF FORM DMS-4A,
60C "STATEMENT OF CONTROLLED MATERIALS REQUIREMENTS FOR CLASS "A" PRODUCTS
70C PRODUCTION OR RESEARCH AND DEVELOPMENT."
80C
90C
100C THE PROGRAM WILL - 1)PRINT THE NAME, ADDRESS AND CONTROL # OF
110C EACH REPORTING CONTRACTOR ENTERED DURING DATA INPUT; 2) STORE AND
120C PRINT CONTROLLED MATERIALS FACTORS FOR DMS PROGRAMS A-1, A-2, A-6,
130C A-7, C-2, C-3, C-9; 3) PRINT AND TOTAL REPORTED MATERIALS QUANTITIES
140C TO SIMPLIFY INPUT DATA AUDITING PROCEDURES; 4) EMPLOY MATRIX
150C ALGEBRA TO COMPUTE AND PRINT SPECIFIC MATERIALS REQUIREMENTS IN
160C SIMILAR FORM AND CONTENT OF FORMS DD-614, AND 614-1, "MATERIALS
170C REQUIREMENTS."
180C
190C EACH FUNCTION/SUB-ROUTINE IS DOCUMENTED BY COMMENT LINES PRECEDING
200C DOCUMENTATION AREAS.  EACH COMMENT LINE CONTAINS A SHORT PURPOSE OR
210C FUNCTION STATEMENT AND A BRIEF DESCRIPTION FOR SUPPORTING OR
220C CLARIFICATION PURPOSES.
230C
240C LIST AND DESCRIPTION OF VARIABLE NAMES*
250C ***************************************
260C
270C    ADDRESP - AN ARRAY WHICH CONTAINS CONTRACTOR ADDRESSES AND CONTROL
280C              NUMBERS FOR VERIFICATION PURPOSES.
290C    ADDRES  - FILE WHICH CONTAINS INFORMATION FOR ADDRESP.
300C    CONTRNO - CONTRACTOR CONTROL NUMBER.
310C    DATATOT - AN ARRAY WHICH CONTAINS TOTALLED CONTRACTOR INPUT DATA.
320C    DATA    - AN ARRAY FOR INPUT OF CONTRACTOR DATA.
330C    FACTA1  - FILE WHICH CONTAINS A-1 PROGRAM FACTORS.
340C    FACTA2  -   "    "       "    A-2    "       "
350C    FACTA6  -   "    "       "    A-6    "       "
```

```
360C     FACTA7  -   "    "       "   A-7    "        "
370C     FACTC2  -   "    "       "   C-2    "        "
380C     FACTC3  -   "    "       "   C-3    "        "
390C     FACTC9  -   "    "       "   C-9    "        "
400C     FACT1   - AN ARRAY FOR STORAGE OF DATA FOR THE A-1 PROGRAM.
410C     FACT2   -  "   "    "     "     "   "   "   "  A-2     "
420C     FACT3   -  "   "    "     "     "   "   "   "  A-6     "
430C     FACT4   -  "   "    "     "     "   "   "   "  A-7     "
440C     FACT5   -  "   "    "     "     "   "   "   "  C-2     "
450C     FACT6   -  "   "    "     "     "   "   "   "  C-3     "
460C     FACT7   -  "   "    "     "     "   "   "   "  C-9     "
470C     GDATATOT- AN ARRAY WHICH CONTAINS TOTALLED CONTRACTOR INPUTS.
480C     QTOT    - AN ARRAY WHICH CONTAINS QTRLY COLUMN TOTALS.
490C
500C ACCESS STATEMENT - TO GAIN ACCESS TO THE AIR FORCE INSTITUTE OF
510C TECHNOLOGY(AFIT) PROGRAM LIBRARY WHICH CONTAINS MATRIX ALGEGRA
520C PROGRAMS USED.  PROGRAM NAME AND ROUTINE(S) USED WILL BE IDENTIFIED
530C AS APPROPRIATE.  REFER TO APPROPRIATE THESIS APPENDIX FOR LISTING OF
540C PROGRAM/ROUTINE USED (SEE LINE NUMBER 10).
550C
```

Figure 5 Computer Listing Section 1

```
560C DECLARATIVE STATEMENT - ESTABLISHES STORAGE SPACE ON CURRENT
570C FILE IN MATRIX FORMAT; EITHER REAL NUMBERS OR ALPHA CHARACTERS.
580C
590 REAL DATA(8,4),QTOT(4),DATATOT(8,4),FACT1(9,9)
600 REAL FACT2(9,9),FACT3(9,9),FACT4(9,9),FACT5(9,9)
610 REAL FACT6(9,9),FACT7(9,9),GDATATOT(8,4)
620 CHARACTER ADDRESP*30(345,2),CONTRNO*19
630C
640C CALL/ATTACH STATEMENT - CALLS SUBROUTINES ENCLOSED WITHIN
650C QUOTATION MARKS TO CURRENT FILE.
660C
670 CALL ATTACH(11,"78A55/FACTA1;",1,0,,)
680 CALL ATTACH(12,"78A55/FACTA2;",1,0,,)
690 CALL ATTACH(13,"78A55/FACTA6;",1,0,,)
700 CALL ATTACH(14,"78A55/FACTA7;",1,0,,)
710 CALL ATTACH(15,"78A55/FACTC2;",1,0,,)
720 CALL ATTACH(16,"78A55/FACTC3;",1,0,,)
730 CALL ATTACH(17,"78A55/FACTC9;",1,0,,)
740 CALL ATTACH(18,"78A55/ADDRES;",1,0,,)
750C
760C READ STATEMENT - READS THE VARIOUS FACTOR MATRICES ONTO
770C THE CURRENT FILE.  REFER TO APPENDIX LISTING BY PROGRAM
780C NAME "USERLIB" AND ROUTINE "MATREAD".
790C
800 M=MATREAD(FACT1,9,9,11,0,0,0,0,"(V)")
810 M=MATREAD(FACT2,9,9,12,0,0,0,0,"(V)")
820 M=MATREAD(FACT3,9,9,13,0,0,0,0,"(V)")
830 M=MATREAD(FACT4,9,9,14,0,0,0,0,"(V)")
840 M=MATREAD(FACT5,9,9,15,0,0,0,0,"(V)")
850 M=MATREAD(FACT6,9,9,16,0,0,0,0,"(V)")
860 M=MATREAD(FACT7,9,9,17,0,0,0,0,"(V)")
870C
```

Figure 6 Computer Listing Section 2

The matrix will consist of eight rows and four columns for the storage of numeric characters to be treated as real numbers. The same operation is continued for the next two REAL declaration lines. The CHARACTER declaration line accomplishes a similar function except that the maximum amount of alpha-numeric characters to be stored per field is specified. The ADDRESP*30(345,2) statement means that a matrix of three hundred forty-five lines with two fields is created and that each field is limited to thirty characters.

Immediately following the CALL/ATTACH documentation statement are eight lines similarly titled. Each CALL/ATTACH line instructs the computer to locate and read the file whose name is enclosed by parentheses. During a program run, for example, the computer will locate the permanent file entitled FACTA1 stored under USERID 78A55 and transfer that file to its current file with an assigned file code of 11.

The next series of lines initialized by M = MATREAD instruct the computer to read the file names enclosed by parentheses. For example, the first line of the MATREAD series instructs the computer to read the file FACT1 as a nine by nine matrix using FORMAT (V) free-field read instructions from a file assigned the file code of 11.

The two series of CALL/ATTACH and MATREAD statements perform a crucial function during computer operations.

The CALL/ATTACH statements bring the identified files from the computer's permanent file to its current file under the assigned file code. The MATREAD statements thereupon read the information from the assigned file code and store that information under the stated file name on the current file. This transfer of information from one file to another enables the computer to perform matrix algebra functions each time the program is run. This stems from the fact that at the end of each computer run, each variable name file contains data which must be purged or erased. Each program termination accomplishes the purge of current file contents.

At this point, the contents of files FACTA1, FACTA2, FACTA6, FACTA7, FACTC2, FACTC3, and FACTC9 require explanation to enhance understanding of the matrix algebra functions to be performed. The seven named files are nine by nine matrices composed of the factor constants used to compute the seventy-three materials sub-classifications. Each matrix consists of eighty-one cells, of which, seventy-three contain factor constants. Each factor constant bears a direct relationship to appropriate DD codes as shown by Figure 7. A listing of each matrix is displayed in Appendix E.

Section 3. This section marks a turning point in program function. Program instructions to the computer begin to generate system output (Figure 8).

1200	1211	1212	1215	1221	1222	1223	1225	1231
1232	1240	1251	1252	1261	1262	1270	1280	1290
1300	1311	1312	1314	1321	1322	1331	1340	1351
1352	1355	1370	1380	1390	1000	1400	0600	0601
0602	0603	1510	1511	1512	1513	1514	1520	1521
1522	1523	1510 1520	1530	1540	1550	1551	1552	1600
1610	1611	1612	1620	1630	1651	1652	1653	1654
1661	1662	1663	1664	1670	1671	1680	1691	1692
1693								

Figure 7 Factor Constant and DD Codes Relationship

```
880C READ STATEMENT - READS THE CONTRACTOR ADDRESS LIST AND
890C CONTROL NUMBERS ENTERED DURING INPUT.
900C
910 DO 1 I=1,345
920 READ (18,1030)(ADDRESP(I,K),K=1,2)
930 1 CONTINUE
940C
950 PRINT,"THE FOLLOWING IS THE CONTRACTOR ADDRESS LIST"
960 PRINT,"*********************************************"
970C PRINT STATEMENT - PRINTS ADDRESSES AND CONTROL NUMBERS.
980C
990 DO 2 I=1,345
1000 PRINT 1030,(ADDRESP(I,K),K=1,2)
1010 2 CONTINUE
1020 1030 FORMAT(1X,A30,3X,A30)
1025 PRINT 700
1027 700 FORMAT(1H1)
1030C
1040C PRINT STATEMENT - PRINTS PROGRAM FACTORS IN MATRIX FORMAT
1050C FOR VERIFICATION OF FACTORS BY PROGRAM USER.  ALL THE
1060C FOLLOWING "MATWRITE" STATEMENTS ARE USED TO ACCOMPLISH THE
1070C SAME FUNCTION.  REFER TO APPENDIX LISTING BY PROGRAM NAME
1080C "USERLIB" AND ROUTINE "MATWRITE."
1090C
1100 PRINT,"   "
1110 PRINT,"A-1 PROGRAM FACTORS:"
1120 M=MATWRITE(FACT1,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1130 PRINT,"   "
1140 PRINT,"A-2 PROGRAM FACTORS:"
1150 M=MATWRITE(FACT2,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1160 PRINT,"   "
1170 PRINT,"A-6 PROGRAM FACTORS:"
1180 M=MATWRITE(FACT3,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1190 PRINT,"   "
1200 PRINT,"A-7 PROGRAM FACTORS:"
1210 M=MATWRITE(FACT4,9,9,42,0,0,0,0,"(9(F6.3,2X))")
```

```
1220 PRINT,"    "
1230 PRINT,"C-2 PROGRAM FACTORS:"
1240 M=MATWRITE(FACT5,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1250 PRINT,"    "
1260 PRINT,"C-3 PROGRAM FACTORS:"
1270 M=MATWRITE(FACT6,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1280 PRINT,"    "
1290 PRINT,"C-9 PROGRAM FACTORS:"
1300 M=MATWRITE(FACT7,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1310 PRINT,"    "
1320C
1325 PRINT 700
1330C START TO ENTER CONTRACTOR DATA
1340 PRINT,"    "
1350C
```

Figure 8 Computer Listing Section 3

The three lines beginning with DO 1 I = 1,345 initiates a loop to read the content of the file ADDRES. Simply stated, the three line series instructs the computer to transfer the information brought to the current file by a CALL/ATTACH statement and to transfer that information in ADDRES, file code 18, to the file named ADDRESP. The computer thereupon reads and transfers the information by reading three hundred forty-five lines of data consisting of two fields.

After completing the loop, the next eight lines of program instruction initiate an output sequence. The first two PRINT statements cause the computer to print the material enclosed by quotation marks. Next, a loop to print the contents of ADDRESP begins. Specifically, the loop instructs the computer to print three hundred forty-five lines of two field data. The next line, 1030 FORMAT (1X,A30,3X,A30), specifies the format to be followed while printing takes place. Output format consists of two fields of data composed of up to thirty alpha-numeric characters separated by three typed spaces. The PRINT 700 line insures that the next set of system output will begin on a new page.

Next, a series of twenty-two statements cause system output of the material contained in files FACT1, FACT2, FACT3, FACT4, FACT5, FACT6, and FACT7. These files contain the factor constants called to the current file

by the CALL/ATTACH statements described in Section 2. The PRINT statements followed by quotation marks operate as previously described. The lines beginning with M = MATWRITE directs the computer to print the file name enclosed by parentheses and specifies output format.

For example, the first MATWRITE line provides the following instructions. Print the nine by nine matrix entitled FACT1 to three decimal places with two spaces between nine fields of data.

To summarize, this section causes system output of files ADDRES and FACTA1 to FACTC9. This routine will enable users to quickly identify those contractor's reports entered as input data and to verify the accuracy of factor constants used to compute materials sub-classification amounts.

Section 4. Section 4 provides the means by which data in the form of controlled materials estimates are input to the program for manipulation.

Program instructions for this section start with the line beginning with M = MATINIT, which directs the computer to initialize the file GDATATOT to zero (Figure 9). Specifically, the area enclosed by parentheses states that the file GDATATOT is composed of eight rows and four columns and is to be initialized to a value of zero from row one to row eight and from column one to column four. The initialization of the file assures the accuracy of the

```
1360 M=MATINIT(GDATATOT,8,4,0,1,8,1,4)
1370 5 PRINT,"    "
1380 READ,CONTRNO
1390C
1400C LOGICAL "IF" STATEMENT - ASSERTION AND CONTINGENT STATEMENT
1410C PORTIONS ARE USED TO DETERMINE WHICH PROGRAM FACTOR MATRIX
1420C ARE TO BE USED TO COMPUTE DATA OF THE FORM AND CONTENT OF
1430C DD FORMS 614 AND 614-1.
1440C
1450 IF(CONTRNO.EQ."1")GO TO 50
1460 IF(CONTRNO.EQ."2")GO TO 60
1470 IF(CONTRNO.EQ."6")GO TO 70
1480 IF(CONTRNO.EQ."7")GO TO 80
1490 IF(CONTRNO.EQ."8")GO TO 90
1500 IF(CONTRNO.EQ."3")GO TO 100
1510 IF(CONTRNO.EQ."9")GO TO 110
1520C
1530 M=MATREAD(DATA,8,4,5,0,0,0,0,"(V)")
1540C
```

Figure 9 Computer Listing Section 4

values to be stored in that location as the file is used to store totaled materials requirements estimates for each program.

Directional instructions for input data are provided by the series of IF statements. The IF statements direct input data to appropriate computation locations by means of the numbered code enclosed by quotation marks for each line of instruction. The first IF statement asserts that "IF" CONTRNO equals 1, the data is to be forwarded to the computation location initialized by 50. Contingency provisions assure that should CONTRNO not equal 1, succeeding IF statements provide directional instructions. This sequence of operation requires that input data be prepared in a format to be specified later.

Section 5. Section 5 serves the function of providing the user the means to verify the accuracy of input data. Specifically, the data input from DMS-4A forms is printed directly beneath the contractor control number. By using the contractor control number as a cross-reference, the user can compare the input data with DMS-4A forms for errors made during data input. Moreover, the location of the error will be identified.

During system output, the computer is instructed to read CONTRNO and to print the statement "ENTERED DATA FOR CONTRACTOR #" and the nineteen digit contractor control number (Figure 10). The computer then prints the eight

```
PRINT 1060,CONTRNO
1060 FORMAT(1X,"ENTERED DATA FOR CONTRACTOR # - ",A19//)
C
C PRINT STATEMENT - PRINTS DATA ENTERED IN ORDER TO VERIFY
C CORRECTNESS OF DATA ENTERED.
C
M=MATWRITE(DATA,8,4,42,0,0,0,0,"(4(F14.1,2X))")
C
C VALUE ASSIGNMENT - ZEROES OUT QTOT.
C
DO 20 I=1,4
QTOT(I)=0
20 CONTINUE
C
C DO STATEMENT - ADDS THE COLUMN ENTRIES SO THAT THE USER
C MAY VERIFY ACCURACY OF DATA ENTERED.  THIS USER SPECIFIED
C ROUTINE SERVES AS A MEANS TO PERFORM EXTERNAL ACCURACY AUDITS.
C
DO 30 J=1,4
DO 40 I=1,8
QTOT(J)=QTOT(J)+DATA(I,J)
40 CONTINUE
30 CONTINUE
C
C PRINT STATEMENT - PRINTS COLUMN TOTALS.
C
M=MATWRITE(QTOT,1,4,42,0,0,0,0,"(4(F14.1,2X))")
C
```

Figure 10 Computer Listing Section 5

rows and four columns of input data for that contractor by means of the MATWRITE statement.

The next operation performed is the addition of the column totals of the input data. This user specified data manipulation is the primary method of performing data input accuracy audits. When DMS-4A forms are received, each column is added to yield a "99-line". Upon receiving system output the user will then compare the "99-line" to the column totals produced by the computer. When discrepancies are noted the user will thereupon compare the data input to the DMS-4A form identified by the contractor control number.

This operation is performed in three sequential steps. First, the file QTOT is initialized by means of a loop. The three lines beginning with DO 20 I = 1,4 directs the computer to initialize the one by four file QTOT to zero and to proceed to the next series of program instructions. Second, the eight rows and four columns of data are added and stored in QTOT. Finally, the MATWRITE statement instructs the computer to print the value of QTOT in four fields of data to the nearest tenth. This results in the computer added column totals to be printed directly beneath the input data for each contractor control number.

<u>Section 6</u>. The program instructions contained in Section 6 generate aggregate totals of input data for each of the

seven programs and for all input data. The program instructions are displayed in Figure 11.

The first MATADD statement accomplishes the following: as each complete set of input controlled materials requirements estimates is read by the computer, the eight rows and four columns of data from file DATA is added to file DATATOT. This operation is continued until all the sets of input data for each program is read. The file DATATOT thereupon contains the total amount of controlled materials requirements estimates for that program. The contents of DATATOT is subsequently used to compute the seventy-three materials sub-classification amounts in Section 7.

The next MATADD statement accomplishes a similar function except that the added input sets are contained in file GDATATOT. The file GDATATOT contains the total of all input controlled materials requirements for all programs. This data will be subsequently printed through the use of a MATWRITE statement in Section 7.

<u>Section 7</u>. Section 7 contains the program instructions to compute the seventy-three materials sub-classifications and to print the sub-classifications and the total estimated materials requirements for all the programs.

A routine to compute and print the seventy-three materials sub-classifications for each program is contained

```
1830C COMMAND STATEMENT - PERFORMS ADDITION OF ALL ENTERED DATA
1840C FOR SPECIFIED PROGRAMS.  REFER TO APPENDIX LISTING BY PROGRAM
1850C NAME "USERLIB" AND ROUTINE "MATADD."
1860C
1870 M=MATADD(DATA,8,4,DATATOT,DATATOT)
1880C
1890 M=MATADD(DATA,8,4,GDATATOT,GDATATOT)
1900C
1910 GO TO 5
1920C
```

Figure 11 Computer Listing Section 6

in this section. The following discussion will describe the process for the computation and printing of the A-1 Program. Each of the remaining program computational routines are identical and, therefore, require no further discussion. The contents of Section 7 are displayed in Figure 12.

The A-1 Program routine begins with a PRINT statement which provides a title heading for the printed materials sub-classifications. The following series of MATMULT statements cause the scalar multiplication of files FACT1 and DATATOT to yield the required information. The requirement to perform scalar multiplication stems from the fact that files FACT1 and DATATOT contain the factor constants and the quarterly materials requirements for the A-1 Program, respectively.

The actual process of scalar multiplication, in effect, multiplies the first column of DATATOT by selected rows and columns of FACT1. This occurs as a result of the fact that only the seventy-three materials sub-classifications of the base quarter are required for reporting purposes. Column one of DATATOT corresponds to the total materials requirements of all reporting contractors for the base quarter of the eight reported material classifications for that program. Refer to column (e) of Figure 1 for clarification.

For example, the first MATMULT line multiplies cell (1,1) of DATATOT by the factor constants contained in rows

```
1930C COMMAND STATEMENT - THE FOLLOWING SERIES OF "MATMULT" STATE-
1940C MENTS WILL CAUSE MATRIX MULTIPLICATION OF APPROPRIATE
1950C MATRICES.  REFER TO APPENDIX LISTING BY PROGRAM NAME "USERLIB"
1960C AND ROUTINE "MATMULT."
1970C
1980 50 PRINT,"A-1 PROGRAM COMPUTATIONS."
1990C
2000 M=MATMULT(FACT1,9,9,DATATOT(1,1),1,2,1,9,0)
2010 M=MATMULT(FACT1,9,9,DATATOT(2,1),3,3,1,9,0)
2020 M=MATMULT(FACT1,9,9,DATATOT(2,1),4,4,1,5,0)
2030 M=MATMULT(FACT1,9,9,DATATOT(3,1),4,4,6,7,0)
2040 M=MATMULT(FACT1,9,9,DATATOT(8,1),4,4,8,9,0)
2050 M=MATMULT(FACT1,9,9,DATATOT(8,1),5,5,1,2,0)
2060 M=MATMULT(FACT1,9,9,DATATOT(4,1),5,5,3,9,0)
2070 M=MATMULT(FACT1,9,9,DATATOT(4,1),6,6,1,3,0)
2080 M=MATMULT(FACT1,9,9,DATATOT(5,1),6,6,4,4,0)
2090 M=MATMULT(FACT1,9,9,DATATOT(6,1),6,6,5,8,0)
2100 M=MATMULT(FACT1,9,9,DATATOT(7,1),6,6,9,9,0)
2110 M=MATMULT(FACT1,9,9,DATATOT(7,1),7,9,1,9,0)
2120C
2130C COMMAND STATEMENT - THE FOLLOWING SERIES OF "MATWRITE"
2140C STATEMENTS WILL CAUSE A PRINT-OUT OF DATA COMPATIBLE WITH
2150C FORM AND CONTENT REQUIREMENTS OF FORMS DD 614 AND 614-1
2160C FOR APPLICABLE PROGRAMS.
2170C
2180 M=MATWRITE(FACT1,9,9,42,0,0,0,0,"(9F14.2)")
2190C
2200C COMMAND STATEMENT - THE FOLLOWING SERIES OF "MATINIT" STATE-
2210C MENTS WILL ASSIGN ZERO VALUES IN ALL CELLS OF DATATOT.
2220C REFER TO APPENDIX LISTING BY PROGRAM NAME "USERLIB" AND
2230C ROUTINE "MATINIT."
2240C
2250 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
2255 PRINT 700
2260 GO TO 5
```

```
C
 60 PRINT,"A-2 PROGRAM COMPUTATIONS."
C
 M=MATMULT(FACT2,9,9,DATATOT(1,1),1,2,1,9,0)
 M=MATMULT(FACT2,9,9,DATATOT(2,1),3,3,1,9,0)
 M=MATMULT(FACT2,9,9,DATATOT(2,1),4,4,1,5,0)
 M=MATMULT(FACT2,9,9,DATATOT(3,1),4,4,6,7,0)
 M=MATMULT(FACT2,9,9,DATATOT(8,1),4,4,8,9,0)
 M=MATMULT(FACT2,9,9,DATATOT(8,1),5,5,1,2,0)
 M=MATMULT(FACT2,9,9,DATATOT(4,1),5,5,3,9,0)
 M=MATMULT(FACT2,9,9,DATATOT(4,1),6,6,1,3,0)
 M=MATMULT(FACT2,9,9,DATATOT(5,1),6,6,4,4,0)
 M=MATMULT(FACT2,9,9,DATATOT(6,1),6,6,5,8,0)
 M=MATMULT(FACT2,9,9,DATATOT(7,1),6,6,9,9,0)
 M=MATMULT(FACT2,9,9,DATATOT(7,1),7,9,1,9,0)
C
 M=MATWRITE(FACT2,9,9,42,0,0,0,0,"(9F14.2)")
C
 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
C
 PRINT 700
 GO TO 5
C
 70 PRINT,"A-6 PROGRAM COMPUTATIONS."
C
 M=MATMULT(FACT3,9,9,DATATOT(1,1),1,2,1,9,0)
 M=MATMULT(FACT3,9,9,DATATOT(2,1),3,3,1,9,0)
 M=MATMULT(FACT3,9,9,DATATOT(2,1),4,4,1,5,0)
 M=MATMULT(FACT3,9,9,DATATOT(3,1),4,4,6,7,0)
 M=MATMULT(FACT3,9,9,DATATOT(8,1),4,4,8,9,0)
 M=MATMULT(FACT3,9,9,DATATOT(8,1),5,5,1,2,0)
 M=MATMULT(FACT3,9,9,DATATOT(4,1),5,5,3,9,0)
 M=MATMULT(FACT3,9,9,DATATOT(4,1),6,6,1,3,0)
 M=MATMULT(FACT3,9,9,DATATOT(5,1),6,6,4,4,0)
 M=MATMULT(FACT3,9,9,DATATOT(6,1),6,6,5,8,0)
```

```
2610 M=MATMULT(FACT3,9,9,DATATOT(7,1),6,6,9,9,0)
2620 M=MATMULT(FACT3,9,9,DATATOT(7,1),7,9,1,9,0)
2630C
2640 M=MATWRITE(FACT3,9,9,42,0,0,0,0,"(9F14.2)")
2650C
2660 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
2670C
2675 PRINT 700
2680 GO TO 5
2690C
2700 80 PRINT,"A-7 PROGRAM COMPUTATIONS."
2710C
2720 M=MATMULT(FACT4,9,9,DATATOT(1,1),1,2,1,9,0)
2730 M=MATMULT(FACT4,9,9,DATATOT(2,1),3,3,1,9,0)
2740 M=MATMULT(FACT4,9,9,DATATOT(2,1),4,4,1,5,0)
2750 M=MATMULT(FACT4,9,9,DATATOT(3,1),4,4,6,7,0)
2760 M=MATMULT(FACT4,9,9,DATATOT(8,1),4,4,8,9,0)
2770 M=MATMULT(FACT4,9,9,DATATOT(8,1),5,5,1,2,0)
2780 M=MATMULT(FACT4,9,9,DATATOT(4,1),5,5,3,9,0)
2790 M=MATMULT(FACT4,9,9,DATATOT(4,1),6,6,1,3,0)
2800 M=MATMULT(FACT4,9,9,DATATOT(5,1),6,6,4,4,0)
2810 M=MATMULT(FACT4,9,9,DATATOT(6,1),6,6,5,8,0)
2820 M=MATMULT(FACT4,9,9,DATATOT(7,1),6,6,9,9,0)
2830 M=MATMULT(FACT4,9,9,DATATOT(7,1),7,9,1,9,0)
2840C
2850 M=MATWRITE(FACT4,9,9,42,0,0,0,0,"(9F14.2)")
2860C
2870 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
2880C
2885 PRINT 700
2890 GO TO 5
2900C
2910 90 PRINT,"C-2 PROGRAM COMPUTATIONS."
2920C
2930 M=MATMULT(FACT5,9,9,DATATOT(1,1),1,2,1,9,0)
```

```
2940 M=MATMULT(FACT5,9,9,DATATOT(2,1),3,3,1,9,0)
2950 M=MATMULT(FACT5,9,9,DATATOT(2,1),4,4,1,5,0)
2960 M=MATMULT(FACT5,9,9,DATATOT(3,1),4,4,6,7,0)
2970 M=MATMULT(FACT5,9,9,DATATOT(8,1),4,4,8,9,0)
2980 M=MATMULT(FACT5,9,9,DATATOT(8,1),5,5,1,2,0)
2990 M=MATMULT(FACT5,9,9,DATATOT(4,1),5,5,3,9,0)
3000 M=MATMULT(FACT5,9,9,DATATOT(4,1),6,6,1,3,0)
3010 M=MATMULT(FACT5,9,9,DATATOT(5,1),6,6,4,4,0)
3020 M=MATMULT(FACT5,9,9,DATATOT(6,1),6,6,5,8,0)
3030 M=MATMULT(FACT5,9,9,DATATOT(7,1),6,6,9,9,0)
3040 M=MATMULT(FACT5,9,9,DATATOT(7,1),7,9,1,9,0)
3050C
3060 M=MATWRITE(FACT5,9,9,42,0,0,0,0,"(9F14.2)")
3070C
3080 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
3090C
3095 PRINT 700
3100 GO TO 5
3110C
3120 100 PRINT,"C-3 PROGRAM COMPUTATIONS."
3130C
3140 M=MATMULT(FACT6,9,9,DATATOT(1,1),1,2,1,9,0)
3150 M=MATMULT(FACT6,9,9,DATATOT(2,1),3,3,1,9,0)
3160 M=MATMULT(FACT6,9,9,DATATOT(2,1),4,4,1,5,0)
3170 M=MATMULT(FACT6,9,9,DATATOT(3,1),4,4,6,7,0)
3180 M=MATMULT(FACT6,9,9,DATATOT(8,1),4,4,8,9,0)
3190 M=MATMULT(FACT6,9,9,DATATOT(8,1),5,5,1,2,0)
3200 M=MATMULT(FACT6,9,9,DATATOT(4,1),5,5,3,9,0)
3210 M=MATMULT(FACT6,9,9,DATATOT(4,1),6,6,1,3,0)
3220 M=MATMULT(FACT6,9,9,DATATOT(5,1),6,6,4,4,0)
3230 M=MATMULT(FACT6,9,9,DATATOT(6,1),6,6,5,8,0)
3240 M=MATMULT(FACT6,9,9,DATATOT(7,1),6,6,9,9,0)
3250 M=MATMULT(FACT6,9,9,DATATOT(7,1),7,9,1,9,0)
3260C
3270 M=MATWRITE(FACT6,9,9,42,0,0,0,0,"(9F14.2)")
```

```
3280C
3290 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
3300C
3305 PRINT 700
3310 GO TO 5
3320C
3330 110 PRINT,"C-9 PROGRAM COMPUTATIONS."
3340C
3350 M=MATMULT(FACT7,9,9,DATATOT(1,1),1,2,1,9,0)
3360 M=MATMULT(FACT7,9,9,DATATOT(2,1),3,3,1,9,0)
3370 M=MATMULT(FACT7,9,9,DATATOT(2,1),4,4,1,5,0)
3380 M=MATMULT(FACT7,9,9,DATATOT(3,1),4,4,6,7,0)
3390 M=MATMULT(FACT7,9,9,DATATOT(8,1),4,4,8,9,0)
3400 M=MATMULT(FACT7,9,9,DATATOT(8,1),5,5,1,2,0)
3410 M=MATMULT(FACT7,9,9,DATATOT(4,1),5,5,3,9,0)
3420 M=MATMULT(FACT7,9,9,DATATOT(4,1),6,6,1,3,0)
3430 M=MATMULT(FACT7,9,9,DATATOT(5,1),6,6,4,4,0)
3440 M=MATMULT(FACT7,9,9,DATATOT(6,1),6,6,5,8,0)
3450 M=MATMULT(FACT7,9,9,DATATOT(7,1),6,6,9,9,0)
3460 M=MATMULT(FACT7,9,9,DATATOT(7,1),7,9,1,9,0)
3470C
3480 M=MATWRITE(FACT7,9,9,42,0,0,0,0,"(9F14.2)")
3490 PRINT,"   "
3500C
3510 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
3520C
3525 PRINT 700
3530 PRINT,"TOTAL QUARTERLY CONTRACTOR INPUTS FOR ALL PROGRAMS"
3540 PRINT,"**************************************************"
3550 M=MATWRITE(GDATATOT,8,4,42,0,0,0,0,"(4(F14.1,2X))")
3560 STOP
3570 END
```

Figure 12 Computer Listing Section 7

one and two, columns one through nine of FACT1. Cell (1,1) of DATATOT contains the total requirements of carbon steel shown as Item 10 in Appendix B. The rows and columns of FACT1 contain the factor constants associated with the DD codes of Item 10 in the same appendix. The remaining lines accomplish the same function for each of the eight item codes. The specific content of each cell multiplied can be determined by cross-reference between Appendices B and D.

Upon completion of all MATMULT computations, the computer is directed to print the computed amounts by a MATWRITE statement. Previous discussion of MATWRITE operations should preclude the need for further explanation of this process. The same holds true for the following MATINIT and PRINT 700 statements.

Each of the following routines to compute and print the seventy-three materials sub-classifications is completed in a sequential manner as directed by the IF statements. Finally, the computer prints the content of GDATATOT and terminates operation. A complete listing of the computer program is contained in Appendix F. A one page sample of each of the four types of system output is contained in Appendix G.

Running the Program

Once operationalized, the user must simply insure that automatic data processing cards to input data are prepared in order to run the program. This section will

discuss the format requirements for input data and provide instructions for reading system output.

Input format. The input format of the data is quite simple and data may be read directly from DMS-4A forms if the following simple rules are kept in mind, see Figure 1.

First, the contractor control number is to be entered. The control number must not exceed nineteen spaces. This can be accomplished by deleting the space separating the priority code and program identification code from the control number. Next, controlled materials requirement estimates are entered by reading from left to right from columns (e) through (h) one line at a time. Each column entry must be separated by a comma. Zeroes must be used to indicate blank columns or rows due to no requirements for that material in that particular quarter. Finally, when all data for a particular program is entered an appropriate program identification end file code must be entered. One data card must be prepared for each of the preceding entries. Specifically, one card for the control number, each line of materials requirements, and the program identification end file code. A sample of input data and a listing of appropriate program identification codes are contained in Figures 13 and 14, respectively.

System output. The output format of each computer run consists of the following in the order presented:

```
DOA1-21-24-194-8484
30,32,32,32
35,37,37,37
108.6,109,110,110.2
2386,2386,2570,2570
2852,3071,3071,3071
0,0,0,0
10013,10784,10790,10800
281983,28190.5,303674,303674
```

Figure 13 Sample Input Data

Program Identification	Data Code
A-1	1
A-2	2
A-6	6
A-7	7
C-2	8
C-3	3
C-9	9

Figure 14 Program Identification Codes

contractor address list, program factor constant list, material requirements estimates by contractor control number for each program identification code, the seventy-three materials sub-classification amount for each program, and a total of all input materials requirements estimates.

The reading and transposition of the sub-classification amounts for each program to DD Forms 614 and 614-1 is a simple task. Each amount printed corresponds directly to the DD code location displayed in Figure 7. For example, the first line of system output consists of DD codes 1200 to 1231. Each DD code amount, then can be transposed to the appropriate block of DD Forms 614 and 614-1.

Summary

The FORTRAN Y computer program was developed on the Honeywell 635 computer located in Air Force Logistics Command Headquarters. The FORTRAN Y computer programming language is adaptable to other computer systems which accept FORTRAN based program languages.

The computer program consists of seven sections. The sections provide an overview of program capabilities, call off-line storage, print contractor addresses, direct input data to computation locations, print input data, total input materials requirements estimates, and compute the seventy-three materials sub-classification amounts.

The program employs matrix algebra routines through access to computer programs stored in the Air Force Institute of Technology program library. Specifically, five function calls are used. The function calls are MATREAD, MATWRITE, MATINIT, MATADD, and MATMULT.

System output consists of a contractor address list, a program factor constant list, a materials requirements estimate list for each contractor, a materials sub-classification list for each program, and a total input materials requirement estimate list for all programs.

APPENDIX D

MATRIX ALGEBRA FUNCTIONS

```
FUNCTION MATREAD(A,NROW,MCOL,NFILE,NSTART,NSTOP,
&MSTART,MSTOP,FMT)
DIMENSION A(NROW,1)
CHARACTER FMT*80
MATREAD=2
NF=NFILE
NS=NSTART
NP=NSTOP
MS=MSTART
MP=MSTOP
IF(NF.LT.1.OR.NF.GT.43)NF=05
IF(NROW.LE.0.OR.MCOL.LE.0)GO TO 55
IF(NS.LE.0)NS=1
IF(MS.LE.0)MS=1
IF(NP.LE.0.OR.NP.GT.NROW)NP=NROW
IF(MP.LE.0.OR.MP.GT.MCOL)MP=MCOL
IF(NS.GT.NP.OR.MS.GT.MP)GO TO 60
IF(FMT.EQ."        ")FMT="(V)"
DO 25 I=NS,NP
25 READ(NF,FMT,END=50)(A(I,J),J=MS,MP)
GO TO 40
40 MATREAD=1
RETURN
50 M=MATERROR(13,10,I,J)
GO TO 40
55 M=MATERROR(13,1,0,0)
RETURN
60 M=MATERROR(13,3,0,0)
RETURN
END
```

```
310 FUNCTION MATWRITE(A,NROW,MCOL,NFILE,NSTART,NSTOP,
320&MSTART,MSTOP,FMT)
330 DIMENSION A(NROW,1)
340 CHARACTER FMT*80
350 MATWRITE=2
360 NF=NFILE
370 NS=NSTART
380 NP=NSTOP
390 MS=MSTART
400 MP=MSTOP
410 IF(NF.LT.1.OR.NF.GT.43)NF=06
420 IF(NROW.LE.0.OR.MCOL.LE.0)GO TO 50
430 IF(NS.LE.0)NS=1
440 IF(MS.LE.0)MS=1
450 IF(NP.LE.0.OR.NP.GT.NROW)NP=NROW
460 IF(MP.LE.0.OR.MP.GT.MCOL)MP=MCOL
470 IF(NS.GT.NP.OR.MS.GT.MP)GO TO 55
480 IF(FMT.NE."          ")GO TO 25
490 IBIG=NS
500 JBIG = MS
510 KI=1
520 IF(IBIG.EQ.NP)KI=0
530 KJ=1
540 IF(JBIG.EQ.MP)KJ=0
550 DO 10 I=NS+KI,NP
560 DO 10 J=MS+KJ,MP
570 IF(ABS(A(I,J)).LE.ABS(A(IBIG,JBIG)))GO TO 10
580 IBIG=I
590 JBIG=J
600 10 CONTINUE
610 X=9.999999
620 DO 15 J=1,4
630 IF(ABS(A(IBIG,JBIG)).LE.X)GO TO 20
640 15 X=X*1E3
650 20 GO TO (21,22,23,24),J
660 21 FMT="(10F7.3)"
```

```
GO TO 25
22 FMT="(7F10.3)"
GO TO 25
23 FMT="(5F14.3)"
GO TO 25
24 FMT="(5E14.7)"
25 DO 30 I=NS,NP
30 WRITE(NF,FMT)(A(I,J),J=MS,MP)
MATWRITE=1
RETURN
50 M=MATERROR(14,1,0,0)
RETURN
55 M=MATERROR(14,3,0,0)
RETURN
END
```

```
820 FUNCTION MATINIT(A,NROW,MCOL,VALUE,NSTART,NSTOP,MSTART,
830&MSTOP)
840 DIMENSION A(NROW,1)
850 MATINIT=2
860 NS=NSTART
870 NP=NSTOP
880 MS=MSTART
890 MP=MSTOP
900 IF(NROW.LE.0.OR.MCOL.LE.0)GO TO 50
910 IF(NS.LE.0.OR.NS.GT.NROW)NS=1
920 IF(MS.LE.0.OR.MS.GT.MCOL)MS=1
930 IF(NP.LE.0.OR.NP.GT.NROW)NP=NROW
940 IF(MP.LE.0.OR.MP.GT.MCOL)MP=MCOL
950 IF(NS.GT.NP.OR.MS.GT.MP)GO TO 55
960 DO 25 I=NS,NP
970 DO 25 J=MS,MP
980 25 A(I,J)=VALUE
990 MATINIT=1
1000 RETURN
1010 50 M=MATERROR(5,1,0,0)
1020 RETURN
1030 55 M=MATERROR(5,3,0,0)
1040 RETURN
1050 END
```

```
FUNCTION MATADD(A,NROW,MCOL,B,C)
DIMENSION A(NROW,1),B(NROW,1),C(NROW,1)
ISIGN=1;GOTO 10
ENTRY MATSUBTR(A,NROW,MCOL,B,C)
ISIGN=-1
10 MATADD=2
IF(NROW.LE.0.OR.MCOL.LE.0)GO TO 50
DO 25 I=1,NROW
DO 25 J=1,MCOL
25 C(I,J)=A(I,J)+ISIGN*B(I,J)
MATADD=1
RETURN
50 KK=1;IF(ISIGN.LT.0)KK=2
M=MATERROR(KK,1,0,0)
RETURN;END
```

```
FUNCTION MATMULT(A,NROW,MCOL,FACTOR,NSTART,NSTOP,MSTART,
&MSTOP,EXPONT)
DIMENSION A(NROW,1)
NS=NSTART
NP=NSTOP
MS=MSTART
MP=MSTOP
MATMULT=2
IF(NROW.LE.0.OR.MCOL.LE.0)GO TO 50
IF(NS.LE.0.OR.NS.GT.NROW)NS=1
IF(MS.LE.0.OR.MS.GT.MCOL)MS=1
IF(NP.LE.0.OR.NP.GT.NROW)NP=NROW
IF(MP.LE.0.OR.MP.GT.MCOL)MP=MCOL
IF(NS.GT.NP.OR.MS.GT.MP)GO TO 55
M=2
L=2
IF(EXPONT.EQ.0.OR.EXPONT.EQ.1.)M=1
IF(FACTOR.EQ.0)FACTOR=1.
IF(AMOD(EXPONT,1.).EQ.0)L=1
DO 25 I=NS,NP
DO 25 J=MS,MP
GO TO(10,20),M
10 A(I,J)=FACTOR*A(I,J)
GO TO 25
20 GO TO(21,22),L
21 A(I,J)=FACTOR*A(I,J)**INT(EXPONT)
GO TO 25
22 A(I,J)=FACTOR*A(I,J)**EXPONT
25 CONTINUE
MATMULT=1
RETURN
50 M=MATERROR(6,1,0,0)
RETURN
55 M=MATERROR(6,3,0,0)
RETURN
END
```

APPENDIX E

FACTOR MATRICES OF PROGRAM FILES FACTA1, FACTA2, FACTA6, FACTA7, FACTC2, FACTC3, AND FACTC9

A-1 Program Factors

1200	1211	1212	1215	1221	1222	1223	1225	1231
1.000		.084		.461				
1232	1240	1251	1252	1261	1262	1270	1280	1290
	.008	.286	.124					.037
1300	1311	1312	1314	1321	1322	1331	1340	1351
1.000		.462		.029	.445		.029	.017
1352	1355	1370	1380	1390	1000	1400	0600	0601
.018					.463	.537	1.000	.050
0602	0603	1510	1511	1512	1513	1514	1520	1521
.461	.489	.959	.063	.902			.041	.041
1522	1523	1510 1520	1530	1540	1550	1551	1552	1600
		1.000	1.000	1.000				1.000
1610	1611	1612	1620	1630	1651	1652	1653	1654
	.009	.094	.001		.013	.001		
1661	1662	1663	1664	1670	1671	1680	1691	1692
.045	.165	.037		.537	.086	.007		.002
1693								
.003								

A-2 Program Factors

1200 1.000	1211	1212 .115	1215	1221 .193	1222 .043	1223	1225	1231 .037
1232 .069	1240 .201	1251 .094	1252 .205	1261	1262	1270	1280	1290 .043
1300 1.000	1311	1312 .375	1314	1321 .036	1322 .321	1331 .021	1340 .021	1351 .068
1352 .146	1355	1370	1380 .012	1390	1000 .268	1400 .732	0600 1.000	0601 .204
0602 .204	0603 .592	1510 .508	1511 .125	1512 .258	1513 .125	1514	1520 .492	1521 .117
1522 .258	1523 .117	1510 1520 1.000	1530 1.000	1540 1.000	1550	1551	1552	1600 1.000
1610	1611 .068	1612 .062	1620 .011	1630	1651 .019	1652 .016	1653 .011	1654 .011
1661 .011	1662 .075	1663	1664	1670 .224	1671	1680 .019	1691 .445	1692 .016
1693 .012								

A-6 Program Factors

1200 1.000	1211	1212 .031	1251	1221 .055	1222	1223	1225	1231
1232	1240	1251	1252 .914	1261	1262	1270	1280	1290
1300 1.000	1311	1312	1314	1321	1322	1331 .300	1340 .700	1351
1352	1355	1370	1380	1390	1000 .802	1400 .198	0600 1.000	0601
0602	0603	1510 .733	1511	1512 .733	1513	1514	1520 .267	1521 .067
1522 .067	1523 .133	1510 1520 1.000	1530 1.000	1540 1.000	1550	1551	1552	1600 1.000
1610	1611 .270	1612	1620	1630	1651 .175	1652	1653	1654
1661	1662	1663	1664	1670 .183	1671	1680 .372	1691	1692
1693								

A-7 Program Factors

1200 1.000	1211	1212	1215	1221 .072	1222 .072	1223	1225	1231
1232	1240 .133	1251	1252 .615	1261	1262	1270	1280	1290 .108
1300 1.000	1311	1312	1314	1321 .586	1322	1331	1340 .099	1351 .216
1352 .099	1355	1370	1380	1390	1000 .510	1400 .490	0600 1.000	0601 .224
0602 .612	0603 .164	1510 .511	1511 .057	1512 .401	1513 .053	1514	1520 .489	1521 .070
1522 .384	1523 .035	1510 1520 1.000	1530 1.000	1540 1.000	1550	1551	1552	1600 1.000
1610	1611 .001	1612 .005	1620 .004	1630	1651 .001	1652 .003	1653 .003	1654 .001
1661	1662 .001	1663	1664	1670 .017	1671	1680 .002	1691	1692
1693 .962								

C-2 Program Factors

1200 1.000	1211	1212	1215	1221	1222	1223 .110	1225	1231 .485
1232	1240 .055	1251 .141	1252 .087	1261 .005	1262 .007	1270	1280	1290 .110
1300 1.000	1311	1312	1314	1321	1322 .103	1331	1340 .552	1351
1352 .345	1355	1370	1380	1390	1000 .406	1400 .594	0600 1.000	0601
0602	0603	1510 .596	1511 .110	1512 .075	1513 .411	1514	1520 .404	1521 .110
1522 .075	1523 .219	1510 1520 1.000	1530 1.000	1540 1.000	1550	1551	1552	1600 1.000
1610	1611	1612	1620	1630	1651	1652	1653	1654
1661	1662	1663	1664	1670 .767	1671	1680 .233	1691	1692
1693								

C-3 Program Factors

1200 1.000	1211	1212	1215	1221 .046	1222	1223 .091	1225	1231 .343
1232	1240 .198	1251 .068	1252 .068	1261 .057	1262 .049	1270 .019	1280	1290 .061
1300 1.000	1311	1312	1314	1321 .630	1322	1331	1340 .370	1351
1352	1355	1370	1380	1390	1000 .978	1400 .022	0600	0601
0602	0603	1510 .889	1511 .037	1512 .037	1513 .519	1514 .296	1520 .111	1521 .037
1522 .037	1523 .037	1510 1520 1.000	1530 1.000	1540 1.000	1550	1551	1552	1600 1.000
1610	1611	1612 .701	1620 .299	1630	1651	1652	1653	1654
1661	1662	1663	1664	1670	1671	1680	1691	1692
1693								

C-9 Program Factors

1200 1.000	1211	1212	1215	1221	1222	1223	1225	1231
1232	1240 .789	1251 .211	1252	1261	1262	1270	1280	1290
1300 1.000	1311	1312 1.000	1314	1321	1322	1331	1340	1351
1352	1355	1370	1380	1390	1000 1.000	1400	0600	0601
0602	0603	1510 1.000	1511	1512	1513 1.000	1514	1520	1521
1522	1523	1520 1.000	1530 1.000	1540 1.000	1550	1551	1552	1600 1.000
1610	1611	1612	1620	1630	1651	1652	1653	1654
1661 .716	1662 .284	1663	1664	1670	1671	1680	1691	1692
1693								

APPENDIX F

THE COMPUTER PROGRAM WITH ASSOCIATED OFF-LINE FILES

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10*#RUN *=(ULIB)GRADLIB/TSS,R
20C THE FOLLOWING PROGRAM IS DESIGNED TO MANIPULATE DATA RECEIVED BY THE
30C JOINT AERONAUTICAL MATERIALS ACTIVITY(JAMAC) PER REPORTING RQMTS
40C ESTABLISHED BY AND FOR THE DEFENSE MATERIALS SYSTEM (DMS).  THE
50C PROGRAM WILL MANIPULATE DATA OF THE FORM AND CONTENT OF FORM DMS-4A,
60C "STATEMENT OF CONTROLLED MATERIALS REQUIREMENTS FOR CLASS "A" PRODUCTS
70C PRODUCTION OR RESEARCH AND DEVELOPMENT."
80C
90C
100C THE PROGRAM WILL - 1)PRINT THE NAME, ADDRESS AND CONTROL # OF
110C EACH REPORTING CONTRACTOR ENTERED DURING DATA INPUT; 2) STORE AND
120C PRINT CONTROLLED MATERIALS FACTORS FOR DMS PROGRAMS A-1, A-2, A-6,
130C A-7, C-2, C-3, C-9; 3) PRINT AND TOTAL REPORTED MATERIALS QUANTITIES
140C TO SIMPLIFY INPUT DATA AUDITING PROCEDURES; 4) EMPLOY MATRIX
150C ALGEBRA TO COMPUTE AND PRINT SPECIFIC MATERIALS REQUIREMENTS IN
160C SIMILAR FORM AND CONTENT OF FORMS DD-614, AND 614-1, "MATERIALS
170C REQUIREMENTS."
180C
190C EACH FUNCTION/SUB-ROUTINE IS DOCUMENTED BY COMMENT LINES PRECEDING
200C DOCUMENTATION AREAS.  EACH COMMENT LINE CONTAINS A SHORT PURPOSE OR
210C FUNCTION STATEMENT AND A BRIEF DESCRIPTION FOR SUPPORTING OR
220C CLARIFICATION PURPOSES.
230C
240C LIST AND DESCRIPTION OF VARIABLE NAMES*
250C ***************************************
260C
270C    ADDRESP - AN ARRAY WHICH CONTAINS CONTRACTOR ADDRESSES AND CONTROL
280C              NUMBERS FOR VERIFICATION PURPOSES.
290C    ADDRES  - FILE WHICH CONTAINS INFORMATION FOR ADDRESP.
300C    CONTRNO - CONTRACTOR CONTROL NUMBER.
310C    DATATOT - AN ARRAY WHICH CONTAINS TOTALLED CONTRACTOR INPUT DATA.
320C    DATA    - AN ARRAY FOR INPUT OF CONTRACTOR DATA.
330C    FACTA1  - FILE WHICH CONTAINS A-1 PROGRAM FACTORS.
340C    FACTA2  -   "    "       "    A-2    "       "
350C    FACTA6  -   "    "       "    A-6    "       "
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360C    FACTA7  -   "    "       "    A-7    "       "
370C    FACTC2  -   "    "       "    C-2    "       "
380C    FACTC3  -   "    "       "    C-3    "       "
390C    FACTC9  -   "    "       "    C-9    "       "
400C    FACT1   - AN ARRAY FOR STORAGE OF DATA FOR THE A-1 PROGRAM.
410C    FACT2   -  "   "    "     "    "   "   "   "  A-2     "
420C    FACT3   -  "   "    "     "    "   "   "   "  A-6     "
430C    FACT4   -  "   "    "     "    "   "   "   "  A-7     "
440C    FACT5   -  "   "    "     "    "   "   "   "  C-2     "
450C    FACT6   -  "   "    "     "    "   "   "   "  C-3     "
460C    FACT7   -  "   "    "     "    "   "   "   "  C-9     "
470C    GDATATOT- AN ARRAY WHICH CONTAINS TOTALLED CONTRACTOR INPUTS.
480C    QTOT    - AN ARRAY WHICH CONTAINS QTRLY COLUMN TOTALS.
490C
500C ACCESS STATEMENT - TO GAIN ACCESS TO THE AIR FORCE INSTITUTE OF
510C TECHNOLOGY(AFIT) PROGRAM LIBRARY WHICH CONTAINS MATRIX ALGEGRA
520C PROGRAMS USED.  PROGRAM NAME AND ROUTINE(S) USED WILL BE IDENTIFIED
530C AS APPROPRIATE.  REFER TO APPROPRIATE THESIS APPENDIX FOR LISTING OF
540C PROGRAM/ROUTINE USED (SEE LINE NUMBER 10).
550C
560C DECLARATIVE STATEMENT - ESTABLISHES STORAGE SPACE ON CURRENT
570C FILE IN MATRIX FORMAT; EITHER REAL NUMBERS OR ALPHA CHARACTERS.
580C
590 REAL DATA(8,4),QTOT(4),DATATOT(8,4),FACT1(9,9)
600 REAL FACT2(9,9),FACT3(9,9),FACT4(9,9),FACT5(9,9)
610 REAL FACT6(9,9),FACT7(9,9),GDATATOT(8,4)
620 CHARACTER ADDRESP*30(345,2),CONTRNO*19
630C
640C CALL/ATTACH STATEMENT - CALLS SUBROUTINES ENCLOSED WITHIN
650C QUOTATION MARKS TO CURRENT FILE.
660C
670 CALL ATTACH(11,"78A55/FACTA1;",1,0,,)
680 CALL ATTACH(12,"78A55/FACTA2;",1,0,,)
690 CALL ATTACH(13,"78A55/FACTA6;",1,0,,)
700 CALL ATTACH(14,"78A55/FACTA7;",1,0,,)
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710 CALL ATTACH(15,"78A55/FACTC2;",1,0,,)
720 CALL ATTACH(16,"78A55/FACTC3;",1,0,,)
730 CALL ATTACH(17,"78A55/FACTC9;",1,0,,)
740 CALL ATTACH(18,"78A55/ADDRES;",1,0,,)
750C
760C READ STATEMENT - READS THE VARIOUS FACTOR MATRICES ONTO
770C THE CURRENT FILE.  REFER TO APPENDIX LISTING BY PROGRAM
780C NAME "USERLIB" AND ROUTINE "MATREAD".
790C
800 M=MATREAD(FACT1,9,9,11,0,0,0,0,"(V)")
810 M=MATREAD(FACT2,9,9,12,0,0,0,0,"(V)")
820 M=MATREAD(FACT3,9,9,13,0,0,0,0,"(V)")
830 M=MATREAD(FACT4,9,9,14,0,0,0,0,"(V)")
840 M=MATREAD(FACT5,9,9,15,0,0,0,0,"(V)")
850 M=MATREAD(FACT6,9,9,16,0,0,0,0,"(V)")
860 M=MATREAD(FACT7,9,9,17,0,0,0,0,"(V)")
870C
880C READ STATEMENT - READS THE CONTRACTOR ADDRESS LIST AND
890C CONTROL NUMBERS ENTERED DURING INPUT.
900C
910 DO 1 I=1,345
920 READ (18,1030)(ADDRESP(I,K),K=1,2)
930 1 CONTINUE
940C
950 PRINT,"THE FOLLOWING IS THE CONTRACTOR ADDRESS LIST"
960 PRINT,"*******************************************"
970C PRINT STATEMENT - PRINTS ADDRESSES AND CONTROL NUMBERS.
980C
990 DO 2 I=1,345
1000 PRINT 1030,(ADDRESP(I,K),K=1,2)
1010 2 CONTINUE
1020 1030 FORMAT(1X,A30,3X,A30)
1025 PRINT 700
1027 700 FORMAT(1H1)
1030C
1040C PRINT STATEMENT - PRINTS PROGRAM FACTORS IN MATRIX FORMAT
1050C FOR VERIFICATION OF FACTORS BY PROGRAM USER.  ALL THE
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1060C FOLLOWING "MATWRITE" STATEMENTS ARE USED TO ACCOMPLISH THE
1070C SAME FUNCTION.  REFER TO APPENDIX LISTING BY PROGRAM NAME
1080C "USERLIB" AND ROUTINE "MATWRITE."
1090C
1100 PRINT,"   "
1110 PRINT,"A-1 PROGRAM FACTORS:"
1120 M=MATWRITE(FACT1,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1130 PRINT,"   "
1140 PRINT,"A-2 PROGRAM FACTORS:"
1150 M=MATWRITE(FACT2,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1160 PRINT,"   "
1170 PRINT,"A-6 PROGRAM FACTORS:"
1180 M=MATWRITE(FACT3,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1190 PRINT,"   "
1200 PRINT,"A-7 PROGRAM FACTORS:"
1210 M=MATWRITE(FACT4,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1220 PRINT,"   "
1230 PRINT,"C-2 PROGRAM FACTORS:"
1240 M=MATWRITE(FACT5,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1250 PRINT,"   "
1260 PRINT,"C-3 PROGRAM FACTORS:"
1270 M=MATWRITE(FACT6,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1280 PRINT,"   "
1290 PRINT,"C-9 PROGRAM FACTORS:"
1300 M=MATWRITE(FACT7,9,9,42,0,0,0,0,"(9(F6.3,2X))")
1310 PRINT,"   "
1320C
1325 PRINT 700
1330C START TO ENTER CONTRACTOR DATA
1340 PRINT,"   "
1350C
1360 M=MATINIT(GDATATOT,8,4,0,1,8,1,4)
1370 5 PRINT,"   "
1380 READ,CONTRNO
1390C
1400C LOGICAL "IF" STATEMENT - ASSERTION AND CONTINGENT STATEMENT
```

```
1410C PORTIONS ARE USED TO DETERMINE WHICH PROGRAM FACTOR MATRIX
1420C ARE TO BE USED TO COMPUTE DATA OF THE FORM AND CONTENT OF
1430C DD FORMS 614 AND 614-1.
1440C
1450 IF(CONTRNO.EQ."1")GO TO 50
1460 IF(CONTRNO.EQ."2")GO TO 60
1470 IF(CONTRNO.EQ."6")GO TO 70
1480 IF(CONTRNO.EQ."7")GO TO 80
1490 IF(CONTRNO.EQ."8")GO TO 90
1500 IF(CONTRNO.EQ."3")GO TO 100
1510 IF(CONTRNO.EQ."9")GO TO 110
1520C
1530 M=MATREAD(DATA,8,4,5,0,0,0,0,"(V)")
1540C
1550 PRINT 1060,CONTRNO
1560 1060 FORMAT(1X,"ENTERED DATA FOR CONTRACTOR # - ",A19//)
1570C
1580C PRINT STATEMENT - PRINTS DATA ENTERED IN ORDER TO VERIFY
1590C CORRECTNESS OF DATA ENTERED.
1600C
1610 M=MATWRITE(DATA,8,4,42,0,0,0,0,"(4(F14.1,2X))")
1620C
1630C VALUE ASSIGNMENT - ZEROES OUT QTOT.
1640C
1650 DO 20 I=1,4
1660 QTOT(I)=0
1670 20 CONTINUE
1680C
1690C DO STATEMENT - ADDS THE COLUMN ENTRIES SO THAT THE USER
1700C MAY VERIFY ACCURACY OF DATA ENTERED.  THIS USER SPECIFIED
1710C ROUTINE SERVES AS A MEANS TO PERFORM EXTERNAL ACCURACY AUDITS.
1720C
1730 DO 30 J=1,4
1740 DO 40 I=1,8
1750 QTOT(J)=QTOT(J)+DATA(I,J)
```

```
40 CONTINUE
30 CONTINUE
C
C PRINT STATEMENT - PRINTS COLUMN TOTALS.
C
M=MATWRITE(QTOT,1,4,42,0,0,0,0,"(4(F14.1,2X))")
C
C COMMAND STATEMENT - PERFORMS ADDITION OF ALL ENTERED DATA
C FOR SPECIFIED PROGRAMS.  REFER TO APPENDIX LISTING BY PROGRAM
C NAME "USERLIB" AND ROUTINE "MATADD."
C
M=MATADD(DATA,8,4,DATATOT,DATATOT)
C
M=MATADD(DATA,8,4,GDATATOT,GDATATOT)
C
GO TO 5
C
C COMMAND STATEMENT - THE FOLLOWING SERIES OF "MATMULT" STATE-
C MENTS WILL CAUSE MATRIX MULTIPLICATION OF APPROPRIATE
C MATRICES.  REFER TO APPENDIX LISTING BY PROGRAM NAME "USERLIB"
C AND ROUTINE "MATMULT."
C
50 PRINT,"A-1 PROGRAM COMPUTATIONS."
C
M=MATMULT(FACT1,9,9,DATATOT(1,1),1,2,1,9,0)
M=MATMULT(FACT1,9,9,DATATOT(2,1),3,3,1,9,0)
M=MATMULT(FACT1,9,9,DATATOT(2,1),4,4,1,5,0)
M=MATMULT(FACT1,9,9,DATATOT(3,1),4,4,6,7,0)
M=MATMULT(FACT1,9,9,DATATOT(8,1),4,4,8,9,0)
M=MATMULT(FACT1,9,9,DATATOT(8,1),5,5,1,2,0)
M=MATMULT(FACT1,9,9,DATATOT(4,1),5,5,3,9,0)
M=MATMULT(FACT1,9,9,DATATOT(4,1),6,6,1,3,0)
M=MATMULT(FACT1,9,9,DATATOT(5,1),6,6,4,4,0)
M=MATMULT(FACT1,9,9,DATATOT(6,1),6,6,5,8,0)
M=MATMULT(FACT1,9,9,DATATOT(7,1),6,6,9,9,0)
```

```
2110 M=MATMULT(FACT1,9,9,DATATOT(7,1),7,9,1,9,0)
2120C
2130C COMMAND STATEMENT - THE FOLLOWING SERIES OF "MATWRITE"
2140C STATEMENTS WILL CAUSE A PRINT-OUT OF DATA COMPATIBLE WITH
2150C FORM AND CONTENT REQUIREMENTS OF FORMS DD 614 AND 614-1
2160C FOR APPLICABLE PROGRAMS.
2170C
2180 M=MATWRITE(FACT1,9,9,42,0,0,0,0,"(9F14.2)")
2190C
2200C COMMAND STATEMENT - THE FOLLOWING SERIES OF "MATINIT" STATE-
2210C MENTS WILL ASSIGN ZERO VALUES IN ALL CELLS OF DATATOT.
2220C REFER TO APPENDIX LISTING BY PROGRAM NAME "USERLIB" AND
2230C ROUTINE "MATINIT."
2240C
2250 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
2255 PRINT 700
2260 GO TO 5
2270C
2280 60 PRINT,"A-2 PROGRAM COMPUTATIONS."
2290C
2300 M=MATMULT(FACT2,9,9,DATATOT(1,1),1,2,1,9,0)
2310 M=MATMULT(FACT2,9,9,DATATOT(2,1),3,3,1,9,0)
2320 M=MATMULT(FACT2,9,9,DATATOT(2,1),4,4,1,5,0)
2330 M=MATMULT(FACT2,9,9,DATATOT(3,1),4,4,6,7,0)
2340 M=MATMULT(FACT2,9,9,DATATOT(8,1),4,4,8,9,0)
2350 M=MATMULT(FACT2,9,9,DATATOT(8,1),5,5,1,2,0)
2360 M=MATMULT(FACT2,9,9,DATATOT(4,1),5,5,3,9,0)
2370 M=MATMULT(FACT2,9,9,DATATOT(4,1),6,6,1,3,0)
2380 M=MATMULT(FACT2,9,9,DATATOT(5,1),6,6,4,4,0)
2390 M=MATMULT(FACT2,9,9,DATATOT(6,1),6,6,5,8,0)
2400 M=MATMULT(FACT2,9,9,DATATOT(7,1),6,6,9,9,0)
2410 M=MATMULT(FACT2,9,9,DATATOT(7,1),7,9,1,9,0)
2420C
2430 M=MATWRITE(FACT2,9,9,42,0,0,0,0,"(9F14.2)")
2440C
2450 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
```

```
2460C
2465 PRINT 700
2470 GO TO 5
2480C
2490 70 PRINT,"A-6 PROGRAM COMPUTATIONS."
2500C
2510 M=MATMULT(FACT3,9,9,DATATOT(1,1),1,2,1,9,0)
2520 M=MATMULT(FACT3,9,9,DATATOT(2,1),3,3,1,9,0)
2530 M=MATMULT(FACT3,9,9,DATATOT(2,1),4,4,1,5,0)
2540 M=MATMULT(FACT3,9,9,DATATOT(3,1),4,4,6,7,0)
2550 M=MATMULT(FACT3,9,9,DATATOT(8,1),4,4,8,9,0)
2560 M=MATMULT(FACT3,9,9,DATATOT(8,1),5,5,1,2,0)
2570 M=MATMULT(FACT3,9,9,DATATOT(4,1),5,5,3,9,0)
2580 M=MATMULT(FACT3,9,9,DATATOT(4,1),6,6,1,3,0)
2590 M=MATMULT(FACT3,9,9,DATATOT(5,1),6,6,4,4,0)
2600 M=MATMULT(FACT3,9,9,DATATOT(6,1),6,6,5,8,0)
2610 M=MATMULT(FACT3,9,9,DATATOT(7,1),6,6,9,9,0)
2620 M=MATMULT(FACT3,9,9,DATATOT(7,1),7,9,1,9,0)
2630C
2640 M=MATWRITE(FACT3,9,9,42,0,0,0,0,"(9F14.2)")
2650C
2660 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
2670C
2675 PRINT 700
2680 GO TO 5
2690C
2700 80 PRINT,"A-7 PROGRAM COMPUTATIONS."
2710C
2720 M=MATMULT(FACT4,9,9,DATATOT(1,1),1,2,1,9,0)
2730 M=MATMULT(FACT4,9,9,DATATOT(2,1),3,3,1,9,0)
2740 M=MATMULT(FACT4,9,9,DATATOT(2,1),4,4,1,5,0)
2750 M=MATMULT(FACT4,9,9,DATATOT(3,1),4,4,6,7,0)
2760 M=MATMULT(FACT4,9,9,DATATOT(8,1),4,4,8,9,0)
2770 M=MATMULT(FACT4,9,9,DATATOT(8,1),5,5,1,2,0)
2780 M=MATMULT(FACT4,9,9,DATATOT(4,1),5,5,3,9,0)
2790 M=MATMULT(FACT4,9,9,DATATOT(4,1),6,6,1,3,0)
2800 M=MATMULT(FACT4,9,9,DATATOT(5,1),6,6,4,4,0)
```

```
2810 M=MATMULT(FACT4,9,9,DATATOT(6,1),6,6,5,8,0)
2820 M=MATMULT(FACT4,9,9,DATATOT(7,1),6,6,9,9,0)
2830 M=MATMULT(FACT4,9,9,DATATOT(7,1),7,9,1,9,0)
2840C
2850 M=MATWRITE(FACT4,9,9,42,0,0,0,0,"(9F14.2)")
2860C
2870 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
2880C
2885 PRINT 700
2890 GO TO 5
2900C
2910 90 PRINT,"C-2 PROGRAM COMPUTATIONS."
2920C
2930 M=MATMULT(FACT5,9,9,DATATOT(1,1),1,2,1,9,0)
2940 M=MATMULT(FACT5,9,9,DATATOT(2,1),3,3,1,9,0)
2950 M=MATMULT(FACT5,9,9,DATATOT(2,1),4,4,1,5,0)
2960 M=MATMULT(FACT5,9,9,DATATOT(3,1),4,4,6,7,0)
2970 M=MATMULT(FACT5,9,9,DATATOT(8,1),4,4,8,9,0)
2980 M=MATMULT(FACT5,9,9,DATATOT(8,1),5,5,1,2,0)
2990 M=MATMULT(FACT5,9,9,DATATOT(4,1),5,5,3,9,0)
3000 M=MATMULT(FACT5,9,9,DATATOT(4,1),6,6,1,3,0)
3010 M=MATMULT(FACT5,9,9,DATATOT(5,1),6,6,4,4,0)
3020 M=MATMULT(FACT5,9,9,DATATOT(6,1),6,6,5,8,0)
3030 M=MATMULT(FACT5,9,9,DATATOT(7,1),6,6,9,9,0)
3040 M=MATMULT(FACT5,9,9,DATATOT(7,1),7,9,1,9,0)
3050C
3060 M=MATWRITE(FACT5,9,9,42,0,0,0,0,"(9F14.2)")
3070C
3080 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
3090C
3095 PRINT 700
3100 GO TO 5
3110C
3120 100 PRINT,"C-3 PROGRAM COMPUTATIONS."
3130C
3140 M=MATMULT(FACT6,9,9,DATATOT(1,1),1,2,1,9,0)
3150 M=MATMULT(FACT6,9,9,DATATOT(2,1),3,3,1,9,0)
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```
3160 M=MATMULT(FACT6,9,9,DATATOT(2,1),4,4,1,5,0)
3170 M=MATMULT(FACT6,9,9,DATATOT(3,1),4,4,6,7,0)
3180 M=MATMULT(FACT6,9,9,DATATOT(8,1),4,4,8,9,0)
3190 M=MATMULT(FACT6,9,9,DATATOT(8,1),5,5,1,2,0)
3200 M=MATMULT(FACT6,9,9,DATATOT(4,1),5,5,3,9,0)
3210 M=MATMULT(FACT6,9,9,DATATOT(4,1),6,6,1,3,0)
3220 M=MATMULT(FACT6,9,9,DATATOT(5,1),6,6,4,4,0)
3230 M=MATMULT(FACT6,9,9,DATATOT(6,1),6,6,5,8,0)
3240 M=MATMULT(FACT6,9,9,DATATOT(7,1),6,6,9,9,0)
3250 M=MATMULT(FACT6,9,9,DATATOT(7,1),7,9,1,9,0)
3260C
3270 M=MATWRITE(FACT6,9,9,42,0,0,0,0,"(9F14.2)")
3280C
3290 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
3300C
3305 PRINT 700
3310 GO TO 5
3320C
3330 110 PRINT,"C-9 PROGRAM COMPUTATIONS."
3340C
3350 M=MATMULT(FACT7,9,9,DATATOT(1,1),1,2,1,9,0)
3360 M=MATMULT(FACT7,9,9,DATATOT(2,1),3,3,1,9,0)
3370 M=MATMULT(FACT7,9,9,DATATOT(2,1),4,4,1,5,0)
3380 M=MATMULT(FACT7,9,9,DATATOT(3,1),4,4,6,7,0)
3390 M=MATMULT(FACT7,9,9,DATATOT(8,1),4,4,8,9,0)
3400 M=MATMULT(FACT7,9,9,DATATOT(8,1),5,5,1,2,0)
3410 M=MATMULT(FACT7,9,9,DATATOT(4,1),5,5,3,9,0)
3420 M=MATMULT(FACT7,9,9,DATATOT(4,1),6,6,1,3,0)
3430 M=MATMULT(FACT7,9,9,DATATOT(5,1),6,6,4,4,0)
3440 M=MATMULT(FACT7,9,9,DATATOT(6,1),6,6,5,8,0)
3450 M=MATMULT(FACT7,9,9,DATATOT(7,1),6,6,9,9,0)
3460 M=MATMULT(FACT7,9,9,DATATOT(7,1),7,9,1,9,0)
3470C
3480 M=MATWRITE(FACT7,9,9,42,0,0,0,0,"(9F14.2)")
3490 PRINT,"   "
3500C
```

```
3510 M=MATINIT(DATATOT,8,4,0,1,8,1,4)
3520C
3525 PRINT 700
3530 PRINT,"TOTAL QUARTERLY CONTRACTOR INPUTS FOR ALL PROGRAMS"
3540 PRINT,"*****************************************************"
3550 M=MATWRITE(GDATATOT,8,4,42,0,0,0,0,"(4(F14.1,2X))")
3560 STOP
3570 END
```

LIST FACTA1

1.00	0	.084	0	.461	0	0	0	0
0	.008	.286	.124	0	0	0	0	.037
1.00	0	.462	0	.029	.445	0	.029	.017
.018	0	0	0	0	.463	.537	1.00	.050
.461	.489	.959	.063	.902	0	0	.041	.041
0	0	1.00	1.00	1.00	0	0	0	1.00
0	.009	.094	.001	0	.013	.001	0	0
.045	.165	.037	0	.537	.086	.007	0	.002
.003	0	0	0	0	0	0	0	0

LIST FACTA2

1.00	0	.115	0	.193	.043	0	0	.037
.069	.201	.094	.205	0	0	0	0	.043
1.00	0	.375	0	.036	.321	.021	.021	.068
.146	0	0	.012	0	.268	.732	1.00	.204
.204	.592	.508	.125	.258	.125	0	.492	.117
.258	.117	1.00	1.00	1.00	0	0	0	1.00
0	.068	.062	.011	0	.019	.016	.011	.011
.011	.075	0	0	.224	0	.019	.445	.016
.012	0	0	0	0	0	0	0	0

LIST FACTA6

1.00	0	.031	0	.055	0	0	0	0
0	0	0	.914	0	0	0	0	0
1.00	0	0	0	0	0	.300	.700	0
0	0	0	0	0	.802	.198	1.00	0
0	0	.733	0	.733	0	0	.267	.067
.067	.133	1.00	1.00	1.00	0	0	0	1.00
0	.270	0	0	0	.175	0	0	0
0	0	0	0	.183	0	.372	0	0
0	0	0	0	0	0	0	0	0

LIST FACTA7

1.00	0	0	0	.072	.072	0	0	0
0	.133	0	.615	0	0	0	0	.108
1.00	0	0	0	.586	0	0	.099	.216
.099	0	0	0	0	.510	.490	1.00	.224
.612	.164	.511	.057	.401	.053	0	.489	.070
.384	.035	1.00	1.00	1.00	0	0	0	1.00
0	.001	.005	.004	0	.001	.003	.003	.001
0	.001	0	0	.017	0	.002	0	0
.962	0	0	0	0	0	0	0	0

LIST FACTC2

1.00	0	0	0	0	0	.110	0	.485
0	.055	.141	.087	.005	.007	0	0	.110
1.00	0	0	0	0	.103	0	.552	0
.345	0	0	0	0	.406	.594	1.00	0
0	0	.596	.110	.075	.411	0	.404	.110
.075	.219	1.00	1.00	1.00	0	0	0	1.00
0	0	0	0	0	0	0	0	0
0	0	0	0	.767	0	.233	0	0
0	0	0	0	0	0	0	0	0

LIST FACTC3

1.00	0	0	0	.046	0	.091	0	.343
0	.198	.068	.068	.057	.049	.019	0	.061
1.00	0	0	0	.630	0	0	.370	0
0	0	0	0	0	.978	.022	0	0
0	0	.889	.037	.037	.519	.296	.111	.037
.037	.037	1.00	1.00	1.00	0	0	0	1.00
0	0	.701	.299	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

LIST FACTC9

1.00	0	0	0	0	0	0	0	0
0	.789	.211	0	0	0	0	0	0
1.00	0	1.00	0	0	0	0	0	0
0	0	0	0	0	1.00	0	0	0
0	0	1.00	0	0	1.00	0	0	0
0	0	1.00	1.00	1.00	0	0	0	1.00
0	0	0	0	0	0	0	0	0
.716	.284	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

APPENDIX G

A SAMPLE OF SYSTEM OUTPUT

THE FOLLOWING IS THE CONTRACTOR ADDRESS LIST
****
A-1 CONTRACTORS

A1-04-01-302-1246
BELL HELI/TEXTRON
PO BOX 482
FORT WORTH TEXAS 76101
ATTN DMS ADMIN/R HURLBURT

A1-04-01-332-5232
HUGHES HELI/SUMMA CORP
CENTINELA AVE & TEALE ST
CULVER CITY CA 90230
ATTN DMS ADMINISTRATOR

A1-04-01-333-7187
BOEING VERTOL CO
PO BOX 16857
PHILADELPHIA PA 19142
ATTN DMS ADM M/SP40-11

A1-04-01-334-1181
BEECH AIRCRAFT CORP
9709 EAST CENTRAL
WICHITA KS 67201
ATTN DMS ADMINISTRATOR

A1-04-11-101-1576
AVCO LYCOMING DIV
550 SOUTH MAIN ST
STRATFORD CT 06497
ATTN DMS ADMINISTRATOR

A1-12-01-289-5956
LOCKHEED CALIFORNIA CO
A DIV OF LOCKHEED ACFT CORP
BURBANK CA 91520
&ATTN DMS ADMINISTRATOR

A-1 PROGRAM FACTORS

1.000	0.	0.084	0.	0.461	0.	0.	0.	0.
0.	0.008	0.286	0.124	0.	0.	0.	0.	0.037
1.000	0.	0.462	0.	0.029	0.445	0.	0.029	0.017
0.018	0.	0.	0.	0.	0.463	0.537	1.000	0.050
0.461	0.489	0.959	0.063	0.902	0.	0.	0.041	0.041
0.	0.	1.000	1.000	1.000	0.	0.	0.	1.000
0.	0.009	0.094	0.001	0.	0.013	0.001	0.	0.
0.045	0.165	0.037	0.	0.537	0.086	0.007	0.	0.002
0.003	0.	0.	0.	0.	0.	0.	0.	0.

A-2 PROGRAM FACTORS

1.000	0.	0.115	0.	0.193	0.043	0.	0.	0.037
0.069	0.201	0.094	0.205	0.	0.	0.	0.	0.043
1.000	0.	0.375	0.	0.036	0.321	0.021	0.021	0.068
0.146	0.	0.	0.012	0.	0.268	0.732	1.000	0.204
0.204	0.592	0.508	0.125	0.258	0.125	0.	0.492	0.117
0.258	0.117	1.000	1.000	1.000	0.	0.	0.	1.000
0.	0.068	0.062	0.011	0.	0.019	0.016	0.011	0.011
0.011	0.075	0.	0.	0.224	0.	0.019	0.445	0.016
0.012	0.	0.	0.	0.	0.	0.	0.	0.

ENTERED DATA FOR CONTRACTOR # - D0A3-12-01-024-6784

425.0	590.0	580.0	580.0
180.0	200.0	180.0	180.0
2100.0	3100.0	2100.0	2100.0
1800.0	2300.0	1840.0	1800.0
400.0	600.0	400.0	400.0
16500.0	17000.0	16500.0	16500.0
3.0	28000.0	3.0	3.0
200.0	200.0	200.0	200.0
21608.0	51990.0	21803.0	21763.0

ENTERED DATA FOR CONTRACTOR # - D0A1-04-01-333-7187

1.0	1.0	1.0	1.0
2.0	2.0	2.0	2.0
2000.0	2000.0	2000.0	2000.0
100.0	100.0	100.0	100.0
6000.0	1000.0	500.0	500.0
0.	0.	0.	0.
1.0	5000.0	5000.0	5000.0
0.	0.	0.	0.
8104.0	8103.0	7603.0	7603.0

A-1 PROGRAM COMPUTATIONS.

1692.90	0.	142.20	0.	780.43
0.	13.54	484.17	209.92	0.
2024.80	0.	935.46	0.	58.72
36.45	0.	0.	0.	0.
1213817.14	1287541.41	91660.26	6021.48	86212.26
0.	0.	95579.00	258283.00	32606.00
0.	77108.14	805351.67	8567.57	0.
385540.70	1413649.20	317000.13	0.	4600785.63
25702.71	0.	0.	0.	0.

0.	0.	0.	0.
0.	0.	0.	62.64
901.04	0.	58.72	34.42
1076345.83	1248375.17	2633009.00	131650.45
0.	0.	3918.74	3918.74
0.	0.	0.	8567571.00
111378.42	8567.57	0.	0.
736811.11	59973.00	0.	17135.14
0.	0.	0.	0.

TOTAL QUARTERLY CONTRACTOR INPUTS FOR ALL PROGRAMS

****

4091.6	3847.8	3299.3	2664.5
3006.2	3028.8	2752.1	2669.3
2470023.0	2291967.0	2101677.0	2131106.0
167757.0	168773.0	181666.0	158879.0
402001.0	397740.0	366011.0	356940.0
39748.0	39421.0	36037.0	34307.0
10455339.0	9121744.0	10631435.0	9597167.0
2666375.0	2480553.0	2505886.0	2488231.0

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AUTHOR BIOGRAPHICAL SKETCHES

Captain Pustis holds a Bachelor of Business Administration degree from Texas Christian University. His Air Force experience includes duties in quality assurance and manufacturing operations with the Air Force Plant Representative Office at Thiokol Corporation, Brigham City, Utah. He served in production, contract administration and Officer-In-Charge capacities with the Taichung Field Office, Detachment 9, Air Force Contract Maintenance Center, Republic of China. Upon completion of his masters degree program, Captain Pustis was assigned to the Armament Development and Test Center (ADTC), Eglin AFB, Florida as a Procurement Contracting Officer, Research and Development Contracts Directorate.

Captain Wallace holds a Bachelor of Science degree from the University of Nebraska-Lincoln. His Air Force experience includes duties in the electronic data processing field as a systems supervisor and operations officer. He served in these capacities at Hq SAC, Offutt AFB, Nebraska on the World Wide Military Command and Control System (WWMCCS) and intelligence computer systems, respectively. Upon completion of his masters degree program, Captain Wallace was assigned to the Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio to work at the F-16 System Program Office in the area of foreign military sales.